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VOLUME XX

JULY–DECEMBER

1886

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THE AMERICAN ARCHITECT AND BUILDING NEWS

INDEX TO VOLUME XX.

JULY—DECEMBER, 1886.

ILLUSTRATIONS.

[The figures refer to the number of the journal, and not to the page.]

MID-WEEK ILLUSTRATIONS.

MISCELLANEOUS.

PUBLIC.

ROTCH SCHOLARSHIP DRAWINGS.

[*Included only in the Imperial Edition.*]

STABLE.

STATUES.

INITIAL CUTS.

[*These figures refer to the page of text, not to the plates.*]

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THE AMERICAN ARCHITECT AND BUILDING NEWS.

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CONTENTS

AN extreme case, in some ways, of "careless blasting" occurred in New York last week, which failed of causing a serious loss of life and property by what we conceive to be a very narrow margin. On Third Avenue, between Thirty-eighth and Thirty-ninth Streets, an excavation is making for a building which is to occupy two lots, and the ingenious contractor, who probably never conceived that there could be such a thing as the vibratory transmission of force, thought it would save time and trouble if he should blow off with one blast that portion of the ledge of rock he was at work on, which extended across the front of both lots, and under the adjacent buildings. The ledge, which was about four feet below the level of the street, was drilled in seven places, and four of the shots which were to be fired at the same time by electricity were placed in six-foot holes, and we suppose that it was the firing of this quadruple shot which threw ten feet into the air a large mass of stone which landed in the street, demolishing in its fall the portable engine which operated the steam drills. The statement is made that the blast tore off a piece of the ledge eight feet deep, and extending across the front of both lots. If this is so, the blast would be a large one even for the open workings of a quarry, while for a situation in the midst of a crowded city it was criminal to the highest degree, and if, as the neighbors say, there is no department of the city that will acknowledge it can control the size or character of blasts, we feel that there is room for one more law at least on the overloaded statute books. The fact that the contractor was intelligent enough to take unusual precautions, warning the officials of the Elevated Railroad, stationing flagmen more than a block away on either hand, and heavily timbering over the blast, simply emphasizes the need there is that blasting should be done only by competent persons. Surely, if it is necessary to take out a license to "keep and sell gunpowder," it would not be unreasonable to allow none but licensed experts to explode it. It might be too much to require every blast to be prepared and fired by a mining engineer, but it would be eminently proper to pass and enforce a law that every charge having an explosive power above a fixed limit should be fired only under the supervision of such an expert. The temptation undoubtedly is for city contractors, who may have gained their knowledge of explosives on large engineering works where some of the nitro-compounds were used, to use the same substances for city work, and we do not believe that it is yet safe to place these compounds in the hands of rule-o'-thumb workmen. We think it extremely likely, too, that much of the blasting within city limits could be done with the new zinc or the older lime cartridges, both of which are used successfully in coal mines, and of which we have given descriptions.

THE Massachusetts Legislature has just failed to pass a bill — to become a law on its acceptance by the Boston City Council—establishing the office of fire-marshal for that city. The marshal was to be appointed by the Governor for the term of three years, while his salary of three thousand dollars was to be paid by Suffolk County, that is, mainly by Boston, provided that it and the working expenses of his office should not exceed one-fourth of the tax paid into the city treasury by the insurance companies who write risks on Boston buildings. Besides investigating the cause of every fire and reporting thereon to the fire-commissioners, it was to be his duty in cases where incendiarism was suspected, to follow up the clues and collect the evidence for submission to the district attorney. It seems very proper that a marshal's salary should be paid indirectly by the underwriters, since it is for their distinct benefit that some public official should be charged with the investigation of incendiary fires and the prosecution of the offenders, a task which is now left to the care of chance or the implacability of private revenge. We do not believe, however, that the fire-loss, so far as it is caused by incendiarism, would have been greatly checked by the marshal's efforts, for the reason that we believe that there are comparatively few incendiary fires, even fewer than the careful *Chronicle* catalogues in its tables. We find it stated in these tables that 1,731, or less than thirteen per cent of the 14,197 fires which occurred in the United States during 1885, had an incendiary origin — we trust that the *Chronicle* can support its statements by producing proof of the conviction of at least one thousand incendiaries. A separate table which shows the ratio of incendiary fires to the total number, makes the percentage for 1885 twenty-six, or double that which we deduce from the large table. Why there should be such a discrepancy we do not understand, and, though it discredits the accuracy of the one and the other, and perhaps emphasizes the difficulty of determining what are incendiary fires, we can secure another factor in the problem from this second table, and that is that in the most thickly-settled States the ratio of incendiary fires to the total number of fires is much less than in States where the population is more scattered and social obligations less observed; for instance, we find that in Kentucky this ratio was sixty-six while in Massachusetts it was only twenty-two; in Texas it was fifty, in New York twenty-four. This makes it a fair inference that a relatively small number of incendiary fires occur in communities that are likely to maintain fire-marshals, and though the suppression of incendiarism might have formed an important part of the new marshal's work, we do not think his researches would have thrown much light on the real origin of fires until he had discovered how to endow careless employés with moral courage enough to confess just what act of theirs had brought about the loss of their employer's property.

IN a paper read before La Société de Statistique de Paris in March last, Doctor Choquet discussed the ordinances which at present regulate the construction of theatres and places of amusement, and define the precautionary measures which must be observed during the performances. Much of what he says is of local interest only, so that it is not worth while to follow his entire argument, but he makes several excellent suggestions, which can be adopted as well in this country as in France. Premising with the statement that since 1751 there are records of the burning of seven hundred and twenty-seven theatres, and that, while in the first decade of this period only four were burned, the number of places of amusement burned during the first half of the present decade had risen to one hundred and seventy-four, he makes a good point against the alarmists by reminding them that not only the number of theatres increases from year to year, but also the number of performances given in each, so that the ratio of fires to the number of performances—the commonest cause of disaster—probably does not increase. To the same consolatory conclusion we can come by considering the number of persons destroyed by theatre fires. It is rather appalling to learn that since 1751 six thousand seven hundred and fifty-three lives have been lost at the burnings of theatres, but a little computation will show that the loss has been infinitesimal in comparison with the opportunities. For instance, there are in France three hundred and sixty-three places of amusement, and if we assume that the total number of such places in the world is only five times as great, that at each theatre are given only two hundred performances each year, and that the average attendance at each performance is only two hundred, we discover that the number of spectators who risked their lives by going to a theatre during the last decade exceeds the respectable figure of seven hundred and twenty-two millions. Then assuming that the loss of life might have been as great as it was in the decade 1841–50, when it was greatest, and two thousand one hundred and forty-four

persons fell victims to theatre fires, we discover that a similar loss would represent less than twenty-nine ten-thousandths of one per cent of the total number of spectators. As the factors we have used in this calculation are probably below the mark, we feel confident that in comparison with the fatalities which might overtake the same number of ordinary passers through the streets of the world it is rather safer for an individual to spend a couple of hours in a properly built and carefully conducted theatre, than to pass them in wandering about the streets. It would be a curious inquiry — which we commend alike to the attention of clergymen and theatre-managers, whose views of propriety are oftentimes so at variance — to discover how many churches had been burned throughout the world since 1751, and how many lives had been sacrificed to religious zeal—or its simulation.

DOCTOR CHOQUET approves of most of the regulations now in force — regulations the virtue of which is also acknowledged in this country, and their observance insisted on. But he finds some of them open to improvement: for instance, he suggests that all windows in the dressing-rooms, and other dependencies of the stage, should be glazed with sheets of mica set in wire frames, instead of the usual glass in wooden sashes, arguing that in case of fire they will not burst as soon as heat touches them, and so admit fresh air to quicken the combustion. The lantern or ventilator now usually built over the stage to act as an escape for smoke in case of fire should be left unglazed, or glazed with glass, which would give way at the first touch of flame. He also recommends that, for the same reason, mica should be used for the sides of the oil lamps, which must be lighted, in addition to gas and electric lamps, during a performance, in all passages and stairways; and as all the air suitable for combustion would be consumed by the conflagration, it is necessary, if these oil lamps are to burn steadily or at all in the hour of peril, that they should each be provided with a special fresh-air supply. As to fire-curtains, he believes that the ordinary drop-curtain should be essentially a fire-curtain, say, of wire-cloth embedded in fibre, upon which the usual decoration could be painted, and besides this there should be in front of it a regular fire-curtain made, not of wire-netting, as usual, but of laminæ of corrugated iron, which would wholly prevent the egress into the auditorium of smoke and gases generated on the stage. Each of these curtains should be held up by ropes which, being burned or cut by some employé, would allow the curtains to drop automatically; but to make sure that a fire occurring on any part of the stage should lower the curtain, these ropes should be led to every part of the stage — a difficult thing to arrange. But as this is at best but a blundering device, he urges that in addition to this quasi-automatic arrangement, the management of the curtains should be under the control of some one in a well-protected and isolated position. In short, he attaches more importance to the care, prudence, and intelligent activity of the theatre hands than to any automatic contrivances, and, indeed, specially states that automatic-sprinklers, good as they are, are only suited to small theatres which cannot maintain a properly-organized fire-watch. As to who would make the most serviceable members of this corps, he makes the excellent suggestion that past members of the corps of *sapeurs-pompiers* would be of the utmost value as stage-hands, scene-shifters, and so on, because of their experience in handling fires. This idea seems so sensible that we recommend to municipalities which retire firemen and police-officers who have reached a certain age, in spite of their being still capable of active work, that they should arrange with the theatre-managers of their respective towns to take on as stage-hands and ushers these discharged veterans whose pensions are quite inadequate to their support.

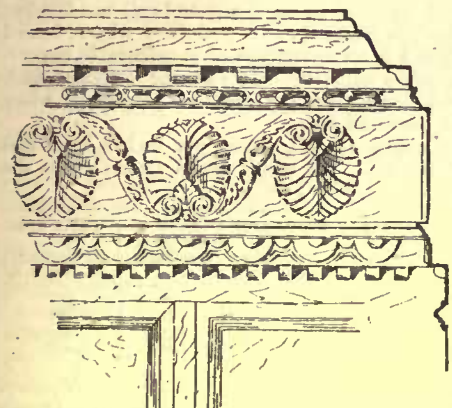
DR. C. S. W. COBBOLD, the resident physician of the Earlswood lunatic asylum in England, recently published, in collaboration with Messrs. Berry and Burmeister, architects, of London, some plans for a model asylum. A correspondent of the *British Architect* criticised the plans, and Dr. Cobbold replied, giving incidentally some suggestions in regard to the planning of hospitals of this kind which seem to us of great importance. The *British Architect's* critic having pointed out that no rooms were set apart for the reception of patients, Dr. Cobbold answered that his scheme provided for a single ward for each sex, to be assigned to "recent and convalescent" cases. In his practice he had observed that convalescent patients exercise a most soothing and cheering influence on those newly admitted; the latter, deriving from the appearance of the others hopeful inferences as to their own recovery, while the mingling of the happy and contented convalescents among the new patients helps to make the latter feel themselves quickly at home. In his opinion it is of the greatest importance to make the insane feel that they are not prisoners, but patients, who have come to the asylum for medical treatment, and it is often useful, for this reason, to take new cases to the sick-wards, where they find their mental disease placed on the same footing as the physical diseases of those about them. In regard to the dormitories for the acute cases, Dr. Cobbold remarks that the plan now most approved is to place such patients in "observation" dormitories, consisting of a large room for the quieter patients, and small rooms for the others, separated by doors with the upper panels either open or glazed with very thick plate glass, so that the attendant, as he walks up and down the ward, can observe the patients in the small rooms without disturbing them by opening the doors.

THE attendants' rooms in Dr. Cobbold's plan are so placed that the only access to them is through the ward, this arrangement being adopted to allow the occasional supervision of the ward by the attendant at night, if any disturbance should occur, or if a patient should have occasion to call him; as well as to secure a certain supervision of the attendant himself by the inmates of the ward. The day-rooms, in this plan, are purposely made large, so that a considerable number of patients can assemble in them, not only for economy of attendance, but because the association of so many patients is rather beneficial than otherwise to them. In regard to the barring of the windows, which the *British Architect's* critic rather sentimentally thinks "ought surely not to be necessary in modern asylums," the Doctor says that "it is necessary even in modern asylums to provide windows of such a kind that the patients cannot get out of them, either by accident or design." The first duty of an asylum superintendent is, he thinks, to prevent the escape of patients who are dangerous to themselves or others, and to effect this the windows must be secured, although it should be done in such a way as to make the building look as little prison-like as possible.

SOME cities which have for the past few years been following the fashion set by New York in the erection of large and small apartment-houses are beginning to regret the sudden craze for living in flats, as the taste for this style of dwelling seems to be waning. Among the Eastern cities, New York stands almost alone in its continued liking for this decidedly French way of living, and the demand for flats there, appears to be permanent. Capital invested in apartment-houses yields a good return, and there is no trouble in finding tenants. The length of time required to reach those outlying places which afford comfortable houses at anything approaching moderate cost tends to make the New York business man cling to his flat. For those whose income falls within, say $5,000, this modern substitute for a home fills a want that nothing else could fill. The elevated railroads afford quick transportation between bed-rooms and business, and the average New Yorker is so wedded to his suite of five or eight rooms that he does not realize the existence of any more complete and satisfactory way of living. Just across the bridge, in Brooklyn, however, there is quite a different state of affairs. A craze for apartment-houses sprang up in Brooklyn three or four years ago, and buildings of that class went up in all sections of the city. A reaction has set in now, and flats are not nearly so popular as they were a year or two ago. In many cases it is impossible to find tenants, and real estate owners who remodelled their houses to meet the prevailing taste are in despair. Boston capitalists, with true Boston conservatism, have probably kept well outside the danger-line in this matter, and as a rule money has not been put into apartment-houses much faster than good business policy authorized. Most of these houses are well and permanently tenanted, and yet some of the most desirable suites, as far as external appearances go, seem to be steadily in the market for rent. Apartment-house living cannot be said to be generally in favor with those people who transact the business of Boston, and life in the suburbs is growing more and more desirable. When quick and comfortable transit shall be provided between the city proper and the beautiful territory that lies all around it, a state of things which can hardly be delayed for many years more, those who are now forced to live in flats will become the happy possessors of suburban homes.

AN EDITOR'S TRIP ABROAD.—II.

LONDON, June 11, 1886.



ST. PETERS HOSPITAL BRISTOL, ENG OAK CORNICE

LONDON AA SKETCH BOOK

It seems to me strange that no one should ever have thought of writing a treatise on the political importance of the English prayer-book. Perhaps it has been done, but if not, I should say, judging from the curious reflections which occurred to me in the course of last Sunday's services on board the *Catalonia*, that it would be a good subject for somebody. On the Cunard steamers, and, I presume, on those of all the other first-class English lines, it is the rule that the captain, either in person or by some acceptable deputy, shall read the service of the Church of England every Sunday morning, and the crew and passengers are required or invited to be present. In our case a general notice of the service was given to all cabin, steerage and intermediate passengers, and the saloon was comfortably filled at the appointed hour with auditors of all three classes, each one of whom found a pretty prayer-book ready for him, stamped with the Cunard seal, and containing the service and the hymns. During the reading, the saloon skylight, which opened through the portion of the deck reserved for the steerage passengers, was darkened from time to time by the apparition of a head, wearing anything but a sympathizing expression, and as I thought of the crowd of men and women on the deck above us, outnumbering the cabin passengers more than ten to one, who would have regarded any participation in the simple service as a serious sin, I began to reflect upon the thousands of instances in which, as the Sunday sun threw its beams over the revolving earth, it would shine upon the same spectacle — a handful of Englishmen saying their prayers calmly together in the middle of an unfriendly multitude, whose hostility or whose courage stopped just short of actual menace. To say nothing of Great Britain itself, the history of the conquest and government of India shows nothing, one might say, more plainly than the power of the mutual support which, aside from the force of organization, Englishmen get in some way from their forms of religious service. The character of their belief has nothing to do with the matter; the secret appears to lie mainly in the accident which led the compilers of the Book of Common Prayer to engage the auditors as well as the minister in the service, so that the Anglo-Saxon on Sunday, instead of gazing mutely at the gold lace on a priest's back, or crawling about a temple floor and knocking his head on the pavement, stands up like a man before his Creator, acknowledging his own sins, and asking, for others as well as himself, mercy and forgiveness; and, like Antæus, refreshed by contact with the earth, he rises from his knees each week with a renewed confidence in the sympathy and support of his fellow-believers, and renewed thoughts of home and duty and eternal happiness, which sustain him, as nothing else can, through the trials which may beset him until the Sunday comes round again. A great deal has been said about the desperate courage which is inspired in Mussulman soldiers by their conviction that if they die fighting for their faith they will enter at once into their rather æsthetic Paradise, and there is no doubt that when death is very near, such considerations have great importance; but the future to which an Englishman who does his duty looks forward is as much more inspiring than that of the Moslem, in the encouragement which it offers to noble deeds, as the habit of candid self-examination and repentance which his religion inculcates is superior, in training him in justice and self-control, to the blind Asiatic fanaticism. I should not care to risk pushing the comparison too far, but it is certainly singular that the great career of the English as conquerors and administrators should have begun with the quarrels of Henry the Eighth and the Pope, and the establishment of the English Church. We are often told that the success of the British in dealing with foreigners is due to their brutality, and that they have simply elbowed themselves into prominence in the world; but they certainly did not discover the use of their elbows for the first time in the reign of Elizabeth, and something else must have been needed to give them that faith in each other's support which has carried them, as it did the Romans, to permanent success in so many enterprises where other nations, stronger than they in the first attack, had failed.

The conclusion of these cogitations was postponed, in the present instance, by the announcement, at the termination of the service, that land was clearly visible to the north of the ship, and the auditors speedily found their way to the deck, to observe the rather unusual spectacle of the Irish coast, lying clear and unclouded from Fastnet Island to Queenstown. The night after leaving Queenstown was clear, but, just before we reached the bar at the mouth of the Mersey, the belated Irish fog caught up with us, and after crawling slowly about in the shallow waters, with the whistle blowing and the sounding-leads busily at work on both sides of the ship, we came to anchor in the mist, and there remained until the middle of the afternoon, when the clouds lifted sufficiently to enable us to go on to the usual anchorage, from which the tenders took us to the landing-stage just in time to miss all the evening trains for London.

The custom-house examination at the landing-stage was much less disagreeable than I had expected. Of late years the baggage of passengers from the United States has been rigidly examined, in search of fire-arms and explosives, neither of which are allowed to enter the country in that way, and we had heard a good deal of the annoyance which American tourists had been made to suffer, so that we were agreeably surprised at the rapidity and courtesy with which the examination was made. Before reaching the anchorage at Liverpool, all the baggage of the passengers, including their state-room trunks, as well as those in the hold, was brought out and piled on the part of the deck appropriated to the intermediate passengers. The trunks and boxes not marked with the owner's name or initials were then ornamented with large initial letters printed on paper and pasted on the trunks, indicating the names of the proprietors, and as soon as the small tender, for the steerage passengers, arrived alongside, all the baggage was transferred into it and sent up to the landing-stage, while the cabin passengers were going on board the large tender reserved for their use. On the arrival of this at the landing-stage, the passengers were, after a brief delay, admitted into a long room, on the wall of which were painted the letters of the alphabet, and under each letter a group of the trunks and boxes belonging to passengers whose names began with that letter. It was thus very easy to find one's trunks, and a few moments sufficed to unlock them, call one of the pleasant, business-like custom-house officers who stood inside a little barrier formed by a narrow raised platform on the floor, and have his experienced hand search every corner of each one, without any serious disarrangement of the contents. The examination over, a small paper label was pasted on each trunk, and a porter of the transfer company stood ready to take them to the baggage-wagon, which, for sixpence apiece, carried them to the Adelphi Hotel, while we amused ourselves by walking there. Never having been in Liverpool before, I was rather struck with the beauty of the buildings. In Water Street, the principal business street, where we stopped on our way, to engage our return passage, there was an immense amount of well-studied and splendidly executed detail, on buildings which were precluded by the narrowness of the street from having any sky-line; but in the wide spaces beyond, extending from St. George's Hall and the Exchange to the hotels and railway stations, there was plenty of charming silhouette, while nearly every building showed the thoughtful arrangement and form of openings, and elegance in the proportioning of heights of stories, and projection and size of string-courses, which, to an architect, give far surer evidence of professional skill than mere richness or novelty of design.

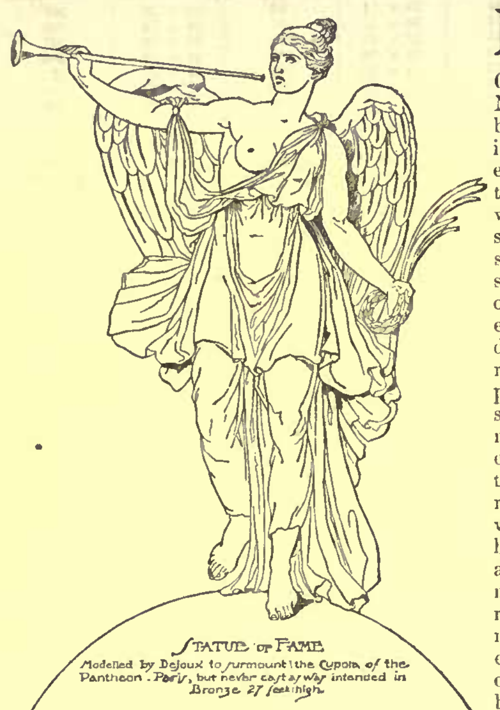
Of novelty, however, there was a good deal, exhibited often in a modest way which was particularly pleasing. Taking advantage of the length of the summer evening, we hurried through our dinner, and then went out and hailed one of the "tram-cars," which were continually passing the front of the hotel, and, mounting to the top, rode to the end of the line and back again. This particular line took us among scenery varying from that of the noisy pierhead, or entrance of the docks, through more and more quiet, suburban streets, to "Dingle," a lovely park just outside the town, now enclosed and set apart for hospital purposes. Although Liverpool, judging from St. George's Hall, which looks as if it were built of coal, seems to be quite as smoky a place as London, the aspect of the streets of little shops and houses through which we passed was quite different from that of the hideously monotonous London streets of the poorer sort. I have never particularly fancied the so-called "polychromatic architecture," and imagine that most architects concede the more conspicuous examples, such as the Opéra at Paris, and Scott's Government offices in Whitehall, to be failures, but hundreds of the little Liverpool shop-fronts were varied with color alone in a manner which one could not help finding pleasant, to say the least. One of the commonest methods of getting effect was to lay the fronts in old English bond, putting alternate headers and stretchers in each course, and to have all the heads enamelled. The rain seems to keep the enamelled surfaces clean long after the ordinary bricks between them have turned black, and they give a regular mottling to the wall, which is much better than no decoration at all. I should say that a still more interesting effect might be obtained by using the same materials with a different bond, such, perhaps, as the French *liaison en croix*, or our own common bond of a continuous row of headers every fifth or seventh course, and perhaps a blue enamel might be pleasanter than the white, but it is evident, from the more ambitious examples which stand near these that simplicity of design is essential to success in such work.

[1] Continued from page 294, No. 547.

THE EARLY WORKS OF MUNKACZY.—A Vienna gentleman went to see Munkaczy in Paris the other day, and explained that he would like to buy some pictures by him; "only," he added, "I cannot afford to pay the price you now ask. Could you tell me where I could find some of your early work, painted when you were a young man in Hungary — something that I could buy cheap?" "Certainly; there are two or three hundred in my native village of Munkacz — the houses I painted when I was Michael Leib, painter and glazier."

NOTES AND DATA ON RADIATORS, HOT-AIR PIPES, AND REGISTERS FOR STEAM HEATING.—II.[1]

COMPOUND COIL RADIATORS.



FOR several years Messrs. Edward E. Gold & Son, of New York, have been experimenting on an extended-surface radiator, made by winding coils of square wire of strong elastic tension around the one-inch pipes of common pipe radiators. These radiators have proved a decided success, doing more work, per cost of radiator, than any other radiator with which they have been tested and are now in the market. These radiators were made the subject of a careful series of experiments by William J. Baldwin, M.E., and Mr. F. W. Wright, the results of which were presented in a paper to the American Society of Mechanical Engineers at its meeting in Boston, November 10 to 13, 1885, and published in the *Sanitary Engineer*, November 26, 1885. From these experiments it was found:

1. That the compound-heater, two pipes in height, and of about the same floor-space occupied by the "pin" radiator, would condense equal or greater quantities of water with equal or greater results in air-warming; and that this radiator may be confidently asserted to be equal to any now in the market.

2. That with the same amount of water condensed the compound-coil heater raised the same amount of air to a *higher temperature* than did the pin radiator with which it was compared. This was accounted for in that the amount of heat lost by radiation in the pin radiator was much greater than in the case of the compound heater.

3. That the passage of air through the compound coil was less impeded than through the pin radiator. In buildings where forced ventilation is employed, this is an advantage of considerable importance, as the writer has often witnessed the extreme difficulty with which the air was drawn through the pin radiators, especially when slightly clogged up with dust and dirt.

These heaters, when cased, are all, twenty-six inches high and forty-nine inches long over all. The width varies according to the amount of heating-surface, as follows: —

Heating Surface. Sq. Feet.	Width over all, including Casing, ins.	Heating Surface. Sq. Feet.	Width over all, including Casing, ins.	Heating Surface. Sq. Feet.	Width over all, including Casing, ins.
24	11	64	23½	104	36
32	13½	72	26	112	38½
40	16	80	28½	120	41
48	18½	88	31	128	43½
56	21	96	33½		

In adapting this radiator to direct radiation, a great improvement has been made upon the usual mode of heating. Owing to the open character of the coils, it was necessary to protect them from dust, etc., by a casing, which is generally of japanned sheet-iron, and it was soon found that by putting registers in the top of the casing, and leaving the bottom open, the temperature of the room could be easily controlled by opening or closing the registers, without shutting off the steam. It will be seen that these heaters do not heat the air by radiation, but by induction, the air passing through the coils and receiving heat from contact with them. The constant circulation of the air in the room caused by this method of heating, also warms the room more evenly than is the case with the common radiator.

These heaters are made either round or rectangular, as desired.

COMPUTATION OF HEATING SURFACE AND DIMENSIONS OF PIPES AND REGISTERS.

To compute the amount of surface required for heating by indirect radiation, the amount of air to be heated per hour in cubic feet should be computed, and from Table IV the amount of air which one foot of radiating-surface will warm in an hour can be found.

This table is based upon the number of heat units that one foot of surface will give off per hour, per degree of difference between the temperature of the steam in the radiator and the air in which it is placed. The number of units must evidently be determined by experiments. The number of heat units given out by one foot of radiating-surface depends in a great measure upon the velocity with which the air passes over and through the radiator; more units being given out when the air is drawn rapidly over the radiator, than when it moves slowly. Hence the rapidity with which the air passes through the radiator must be taken into account in determining the amount of heating-surface.

As a general rule, the air should not move over the radiators in cold weather faster than 300 cubic feet per square foot of radiating surface per hour. Columns 2 and 4 of Table IV are based upon the natural velocity of the heated air, caused by the heat from the radiator alone; the number of heat units per square foot of radiating-surface, per degree difference between the steam in radiator and the fresh air given out per hour, being taken at 1.8.

Columns 3 and 5 gives the number of cubic feet of air which one nominal foot of Gold's pin radiator will heat to 100 and 120 degrees, with a velocity of 300 feet per square foot of radiating-surface per hour. The quantities being based upon the supposition that one foot of surface gives out three heat units per hour per degree difference in temperature between the steam in radiator and the air supplied to it.

TABLE IV.

QUANTITY OF AIR WARMED PER HOUR, BY ONE SQUARE FOOT OF INDIRECT HEATING-SURFACE, WITH NATURAL OR FORCED DRAUGHTS.[2]

Steam pressure above Atmosphere.	Cubic feet of air warmed per hour.			
	10° to 110° F.		0° to 120° F.	
	Natural Draught.	Forced Draught.	Natural Draught.	Forced Draught.
lbs.	Pipe and pin.	Pin.	Pipe and pin.	Pin.
0	150	251	125	208
3	160	267	133	223
5	165	276	138	229
10	177	296	148	246
20	198	330	165	275
30	212	353	177	294
60	245	408	204	340

The writer believes these tables to be as correct as they can be made, with the limited amount of experimental data obtainable.

It has been the almost universal custom of steam-heating companies to estimate the indirect heating surface by rule of thumb, the same as for direct radiation, the only difference being that they doubled the amount of surface for indirect radiation. This did very well where there was no special system of ventilation, but with the

[1] Continued from page 269, No. 545.

Under the head of "Direct Radiation," in the preceding paper, the following table, showing the space occupied by the Bundy Radiator, should have been given:

TABLE III.

DIMENSIONS OF THE BUNDY LOOP CAST-IRON RADIATOR 36 INCHES HIGH.

No. of Loops.	Heating Surface. sq. ft.	Length. ft.	in.	Width. in.	No. of Loops.	Heating Surface. sq. ft.	Length. ft.	in.	Width. in.
				SINGLE ROW OF LOOPS.					
3	9	1	1	6½	13	39	3	9	6½
4	12	1	4	"	14	42	4	0	"
5	15	1	7	"	15	45	4	3	"
6	18	1	10½	"	16	48	4	6½	"
7	21	2	1	"	18	54	5	1	"
8	24	2	5½	"	20	60	5	7	"
9	27	2	8	"	22	66	6	1½	"
10	30	2	11	"	24	72	6	8	"
11	33	3	3	"	26	78	7	2	"
12	36	3	5	"					
				TWO ROWS OF LOOPS.					
6	18	1	1	10½	24	72	3	6	10½
8	24	1	4½	"	26	78	3	9	"
10	30	1	8	"	28	84	4	1	"
12	36	1	11	"	30	90	4	3½	"
14	42	2	2	"	32	96	4	6½	"
16	48	2	5	"	40	120	5	7	"
18	54	2	8	"	44	132	6	1	"
20	60	2	11	"	48	144	6	8	"
22	66	3	2½	"	52	156	7	2½	"
				THREE ROWS OF LOOPS.					
9	27	1	1	14	27	81	2	8	14
12	36	1	4½	"	30	90	3	0	"
15	45	1	7	"	33	99	3	3	"
18	54	1	11	"	36	108	3	6	"
21	63	2	2	"	39	117	3	10	"
24	72	2	5	"	45	135	4	4	"
				FOUR ROWS OF LOOPS.					
16	48	1	5	18⅝	72	216	5	0¼	18⅝
20	60	1	7	"	80	240	5	7½	"
24	72	1	11	"	88	264	6	1½	"
40	120	3	0	"	96	288	6	8	"

CIRCULAR RADIATORS, 36 INCHES HIGH.

No. of Loops.	Heating Surface.	Outside diameter of base.		No. of Loops.	Heating Surface.	Outside diameter of base.	
10	30	1	4	26	78	2	0¾
15	45	1	7¼	31	93	2	3¾
20	60	1	9¼	50	150	2	6¾
22	66	1	9½	72	216	3	1¾

IN HALVES TO ENCIRCLE COLUMNS.

		Outside diameter.		Inside diameter.				Outside diameter.		Inside diameter.	
26	78	2	2		9						
34	102	2	6½	1	1½	50	150	3	0	1	7½

[2] In this table the quantities given for forced draughts are for the pin radiators and Gold's compound coil-radiators only, as the writer could obtain no reliable data of the heat units given off by pipe radiators under forced draughts. This table is computed in the same way as line "C" in Table XIII of "*Steam Heating*," by Robert Briggs, Van Nostrand Science Series.

improved systems of ventilation now employed, such rules of thumb certainly do not reflect much credit upon those who have to do with the heating of large public buildings.

QUANTITY OF AIR TO BE HEATED AND DIMENSIONS OF HOT-AIR PIPES.

It is evident that the area of the cross section of the hot-air pipes will depend upon the amount of air that is to pass through them in a given time. This leads to a consideration of how much air we must heat.

With ordinary systems of automatic ventilation, with nothing but vertical ducts capped with some form of "ventilator," it is impossible to change the air of a room oftener than four times an hour, without overheating the rooms, and in most cases it would be safe to reckon upon three times. Hence the amount of air to be heated per hour in cubic feet will be found by taking the cubical contents of the room, deducting for space taken up by furniture, etc., and multiplying by three or four, as it may be deemed advisable. This will give the number of cubic feet of air that must pass through the hot-air pipes per hour. For this class of ventilation it is not safe to reckon upon a velocity of the air in the pipes at more than 50 cubic feet per square inch of cross-section per hour for the first story, and 70 cubic feet per square inch per hour for the rooms above. Divide the amount of air to be heated per hour by these numbers, and it will give the required area of the hot-air pipes in square inches.

The size of the register will be governed by the size of the pipe. Table V gives the dimensions of rectangular registers as made by the Tuttle Manufacturing Company, and Table VI the capacity of pipes and registers.

TABLE V.

DIMENSIONS OF REGISTERS AND VENTILATORS,
MADE BY THE TUTTLE & BAILEY MANUFACTURING COMPANY.

Size as given on List.	Opening to admit Body of Register.	Extreme Dimensions of Register Face.	Depth of the Register. Closed.	Depth of the Register. Open.	Opening to admit Iron Border.
4½ × 6½	4⅝ × 6⅝	5¾ × 7⅝	1¼	1⅝	—
4 × 8	4 × 8	5½ × 9½	1¾	2¼	—
4 × 10	4 × 10	5¾ × 11¾	1⅝	2¼	—
4 × 13	4 × 13	5⅝ × 15	1⅝	2¼	—
4 × 15	4 × 15	5⅝ × 16⅞	1⅝	2¼	—
4 × 18	4 × 17⅝	5⅝ × 19¼	1⅝	2¼	—
6 × 8	6⅛ × 8⅛	7¾ × 9¾	1⅞	2⅜	10½ × 12½
6 × 9	6¼ × 9	7⅞ × 10¾	1⅞	2⅜	10½ × 13⅛
6 × 10	6⅛ × 10	7⅞ × 12	1⅞	2¼	10½ × 14¾
6 × 14	6⅛ × 13⅞	8 × 15⅝	1⅞	2⅜	10⅝ × 18¼
6 × 16	6⅛ × 16	8 × 17⅞	1¾	2⅜	11⅜ × 21¼
6 × 18	6 × 18	8 × 20	1¾	2½	10¾ × 23
6 × 24	6⅛ × 24½	8 × 26	1¾	2⅜	10⅝ × 28¾
7 × 7	7 × 7	8¾ × 8	2	2¾	11⅜ × 11⅜
7 × 10	7 × 10	8¾ × 11¾	2	2¾	11⅛ × 14⅞
8 × 8	8 × 8	9⅞ × 9⅞	2	3	12⅝ × 12⅝
8 × 10	8 × 10	9⅝ × 11⅝	2	3	13 × 15
8 × 12	8 × 12	9¼ × 13⅝	2	3	13 × 16¾
8 × 15	8 × 15	9¾ × 16⅝	2	3	13 × 19¾
8 × 18	8 × 18	9¾ × 19½	2	3	13 × 22¾
9 × 9	9⅛ × 9⅛	10¾ × 10¾	2¼	3⅜	13¾ × 13¾
9 × 12	9 × 12⅛	10¾ × 13¾	2¼	3⅜	14¼ × 17¼
9 × 13	9¼ × 13¼	11¼ × 15¼	2¼	3⅜	14⅜ × 18¾
9 × 14	9 × 14	11 × 16	2¼	3⅜	14⅛ × 19¼
10 × 10	10¼ × 10¼	12 × 12	2⅜	3⅝	15 × 15
10 × 12	10 × 12	11¾ × 13⅞	2⅜	3⅝	15 × 17
10 × 14	10⅛ × 14⅛	12¼ × 16⅛	2⅜	3⅝	15⅝ × 19⅝
10 × 16	10 × 16	12 × 18	2⅜	3⅝	15⅝ × 21½
12 × 12	12 × 12	14 × 14	2¾	4¼	17⅝ × 17⅝
12 × 15	12⅛ × 15¼	13½ × 16¾	2¾	4¼	16⅝ × 19⅝
12 × 17	12¼ × 17¼	14 × 19	2¾	4¼	17⅞ × 22⅝
12 × 18	12⅛ × 18⅛	14 × 20	2¾	4¼	16⅞ × 23
12 × 19	12⅛ × 19¼	14⅝ × 21	2¾	4¼	17½ × 21¼
12 × 24	12 × 24	13⅞ × 25¾	2¾	4¼	17¼ × 29½
14 × 14	14¼ × 14¼	16⅝ × 16⅝	2⅝	3⅞	20½ × 20½
14 × 18	14¼ × 18¼	16½ × 20¼	2⅝	3⅞	20½ × 24
14 × 22	14¼ × 22	16½ × 24½	2¾	4	20¼ × 27¾
15 × 25	15⅝ × 25½	17⅞ × 27¾	3½	5⅝	22 × 32
16 × 16	16 × 16	18⅜ × 18⅜	3	4½	22 × 22
16 × 20	16⅛ × 20½	17⅝ × 22⅛	3	4½	21¼ × 25½
16 × 24	16⅜ × 24½	18⅜ × 27	3	4½	22 × 30½
20 × 20	20¼ × 20¼	22¼ × 22¼	3½	5¼	26¾ × 26¾
20 × 24	20 × 24	22¼ × 26	3⅝	5⅝	26 × 29¼
20 × 26	20¼ × 26¼	22⅞ × 28⅞	3⅝	5⅝	27¼ × 33¼
21 × 29	20¾ × 29	23⅝ × 31½	3¾	5¾	28 × 36
24 × 24	24 × 24	26¼ × 26¼	—	—	—
27 × 27	27 × 27	29⅛ × 29⅛	3¾	5¾	34 × 34
27 × 38	27 × 38	29¼ × 40¼	4¾	6½	34 × 45
30 × 30	30¼ × 30¼	32¾ × 32¾	4¾	7	37¾ × 37¾

TABLE VI.

ESTIMATED CAPACITY OF PIPES AND REGISTERS.

ROUND PIPES.

Diameter of pipe.	Area in sq. inches.	Diameter of pipe.	Area in sq. inches.	Diameter of pipe.	Area in sq. inches.
7 inches.	38	12 inches.	113	22 inches.	380
8 "	50	14 "	154	24 "	452
9 "	63	16 "	201	26 "	531
10 "	78	18 "	254	28 "	616
11 "	95	20 "	314	30 "	707

RECTANGULAR PIPES.

Size of pipe.	Area in sq. inches.	Size of pipe.	Area in sq. inches.	Size of pipe.	Area in sq. inches.
4 × 8	32	8 × 20	160	12 × 18	216
4 × 10	40	8 × 24	192	12 × 20	240
4 × 12	48	10 × 12	120	12 × 24	288
4 × 16	64	10 × 15	150	14 × 14	196
6 × 10	60	10 × 16	160	14 × 16	224
6 × 12	72	10 × 18	180	14 × 20	280
6 × 16	96	10 × 20	200	16 × 16	256
8 × 10	80	12 × 12	144	16 × 18	288
8 × 12	96	12 × 15	180	16 × 20	320
8 × 16	128	12 × 16	192	16 × 24	384

REGISTERS.

Size of opening.	Capacity in sq. inches.	Size of opening.	Capacity in sq. inches.	Size of opening.	Capacity in sq. inches.
6 × 10	40	10 × 14	93	20 × 20	267
8 × 10	53	10 × 16	107	20 × 24	320
8 × 12	64	12 × 15	120	20 × 26	347
8 × 15	80	12 × 19	152	21 × 29	406
9 × 12	72	14 × 22	205	27 × 27	483
9 × 14	84	15 × 25	250	27 × 38	684
10 × 12	80	16 × 24	256	30 × 30	600

ROUND REGISTERS.

Size of opening.	Capacity in sq. inches.	Size of opening.	Capacity in sq. inches.	Size of opening.	Capacity in sq. inches.
7 inches.	26	12 inches.	75	20 inches.	209
8 "	33	14 "	103	24 "	301
9 "	42	16 "	134	30 "	471
10 "	52	18 "	169	36 "	679

For buildings in which forced ventilation is provided, either by a fan or an aspirating-shaft, the amount of air to be heated should be determined by the number of occupants, if the rooms are continuously occupied by a number of people. Where possible, 3600 cubic feet of air per hour should be allowed to each person, and on no account should less than this amount be provided for hospitals and rooms in which sick people are confined. For schools, 30 cubic feet per minute, or 1800 cubic feet per hour, is recommended, but it is very seldom that more than 1200 is provided, and often not half of this latter amount. In the Boston school-houses built within the past two years, from 15 to 25 cubic feet per minute for each scholar is *actually* provided. In these buildings ventilation is produced by a fan placed in the top of the building, drawing the air from the rooms. The velocity of the air in the hot-air pipes where forced ventilation is employed may be assumed at 146 feet per hour per square *inch* of cross-section. Having settled upon the amount of air to be provided, and the velocity of the supply, the areas of the pipes can be computed as already described.

Example I.—How many feet of radiating surface will be required to heat an office room in the third story, 15 feet by 20 feet, 12 feet high, heated by indirect radiation and automatically ventilated?

Ans.—Cubic contents of room = 3600 cubic feet. Allowing the air to be changed four times per hour, we have the number of feet per hour to be heated, 14,400 cubic feet. Assuming that the boiler will be run at three pounds pressure on the average, and that it is only desirable that the air should issue from the registers at 110°, we find from Column 2, Table IV, that one foot of heating-surface will warm 160 feet, and to warm 14,400 feet will therefore require 90 feet of radiating-surface. The hot-air pipe should have an area of $14,400 \div 70 = 205$ square inches, which would require a 16-inch pipe and a 16-inch × 24-inch register.

Example II. — Compute the radiating surface (pin radiators), dimension of hot-air pipes, and size of registers, for heating a primary school-room, 24 feet by 32 feet by 12 feet, containing fifty-six scholars; it being required to supply each scholar and the teacher with 20 cubic feet of air per minute, the room being ventilated by means of a fan, and the air to come from the registers at a temperature of 110°, steam pressure of three pounds.

Ans. — Amount of air to be heated per hour $= 57 \times 20 \times 60 = 68,400$ cubic feet. From Table IV we see that one foot of pin radiating surface will heat 267 cubic feet of air per hour; hence the amount of radiating surface should be $68,400 \div 267 = 280$ square feet. It would be best to divide this into two stacks of fourteen sections each.

The hot-air pipes should have a combined section of $68,400 \div 146 = 468$ square inches, which would require two 16-inch pipes, and 16-inch by 24-inch registers. As a general thing the pipes are made smaller than this, but it requires more force to pull the air through.

F. E. KIDDER.

THE ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

HOUSES OF J. F. ANDREW, ESQ., BOSTON, MASS., MESSRS. MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y., AND OF MRS. NATHANIEL THAYER. MESSRS. PEABODY & STEARNS, ARCHITECTS, BOSTON, MASS.

[Gelatine Print, issued only with the Imperial Edition.]

HOUSE OF H. C. HULBERT, ESQ., CLIFTON, O. MESSRS. PLYMPTON & TROWBRIDGE, ARCHITECTS, CINCINNATI, O.

FIRST story walls two and one-half feet thick, and built of field-stone or boulders laid in Portland cement. Trimmings around doors and windows of Bedford bluestone, tooth-chiselled work. Second story and gables are framed of 6″ x 8″ posts, 6″ x 6″ and 6″ x 4″ girts, and plates filled in with a 4″ brick wall, and cemented on outside, finishing with Waring's Georgia (buff) cement. The house is sheathed on inside, and furred for lathing and plastering. All the woodwork on exterior is composed of Mississippi cypress. The roof will be of reddish-brown ⅝″ thick, tiles laid in cement. All fireplaces

are lined with vitrified, salt-glazed fire-brick, built in during construction and laid in Flemish bond. The hearths will be raised and composed of the aforesaid brick, and finished with hard-wood borders. The hall, including stair-case, finished in quartered oak. The dining-room finish of cypress, and the entire second and third floors finished in California red-wood. The cost, when completed, including painting, glazing, and plumbing, which are special contracts, will be about $13,000.

PUBLIC LIBRARY, SOMERVILLE, MASS. MR. G. F. LORING, ARCHITECT, BOSTON, MASS.

EXTERIOR face-brick, Longmeadow freestone trimmings, copper ridges, hips, finials, gutters and conductors; Brownville slate. All exterior walls hollow, interior walls, first story, brick, second story, wood; mill floors, second-story floors plastered one inch thick, felt on top; furrings on exterior walls plastered between seven-eighths of an inch on the brick walls; indirect steam, first floor, direct, second floor; inside finish, cherry throughout, with cherry ceilings and beams, first story rooms; vestibule in oak; vestibules and hall, marble tile; all other floors birch. Cost of exterior and rough carpentry work, $13,300; cost of interior finish, plaster, painting, furniture, tiles, grates, gas-fixtures, book-cases, etc., $10,000; cost of heating apparatus, complete, $1,175; cost of grading, walks, asphalt roadways and architects commission about $1,600. Total cost, $26,075.

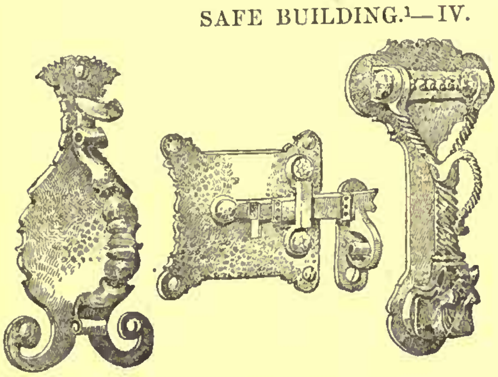
NEW THEOLOGICAL HALL, HAMILTON, ONTARIO, CANADA. MR. T. J. LACEY, ARCHITECT, BINGHAMTON, N. Y.

THIS building is constructed of native stone, quarried from the College grounds, laid in broken ashler, rock face, laid with black joint, relieved with Trenton pressed brick, laid in red mortar, with ornamental brick and terra-cotta trimmings. The interior is finished with native woods. The first story, including the panelled wainscoting, stairways and the wainscoting of the corridors of the upper stories, are finished with quartered oak.

DESIGN FOR A GATE LODGE. MR. H. A. HOWES, JR., ARCHITECT, NEW HAVEN, CONN.

OLD COLONIAL WORK, NOS. IX AND X. DETAILS FOR TRINITY CHURCH, NEWPORT, R. I. MEASURED AND DRAWN BY MESSRS. A. H. EVERETT AND F. E. WALLIS.

SAFE BUILDING.[1]—IV.



Wrought Iron Knockers & Latch for Mr. W. T. Wilson's House — Messrs. J. A. & W. T. Wilson, Architects, Baltimore Md.

THE amounts given in Table IV for compression, tension and shearing are *along* fibres, except where marked *across*.

It will also be noticed that the factors-of-safety chosen are very different; the reason being that where figures seemed reliable the factor chosen was low, and became higher in proportion to the unreliability of the figures. The tables, as they are, are extremely unsatisfactory and unreliable, though the writer has spent much time in their construction. Any one, who will devote to the subject even the slightest research, will find that there are hardly any two original experimenters who agree, and in most cases, the experiments are so carelessly made or recorded that they are of but little value.

TRANSVERSE STRENGTH. — RUPTURE.

If a beam is supported at two ends, and loads are applied to the beam, it is evident: —

1st, that the beam will bend under the load, or *deflect*.

2d, that if the loading continues, the beam will eventually break, or be *ruptured*.

Deflection when non-important. The methods of calculating deflection and rupture differ very greatly. In some cases, where deflection in a beam would do no damage—such as cracking plaster, lowering a column, making a floor too uneven for machinery, etc.,—or where it would not look unsightly, we can leave deflection out of the question, and calculate for rupture only. Where, however, it is important to guard against deflection, we must calculate for both.

REACTION OF SUPPORTS.

If we imagine the loaded beam supported at both ends by two giants, it is evident that each giant would have to exert a certain amount of force upwards to keep his end of the beam from tipping.

We can therefore imagine in all cases the supports to be resisting or *reacting* with force sufficient to uphold their respective ends.

Amount of Reaction. The amount of this reaction for either support is equal to the load multiplied by its distance from the further support, the whole divided by the length, or

$$p = \frac{w.\ n}{l} \qquad (14)$$

Where p = the amount of the *left* hand reaction or supporting force.

$$\text{and } q = \frac{w.\ m}{l} \qquad (15)$$

Where q = the amount of the *right* hand reaction or supporting force.

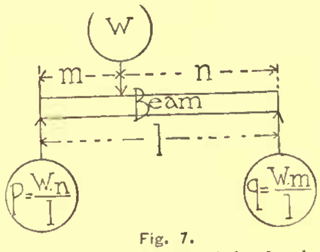


Fig. 7.

If there are several loads the same law holds good for each, the reaction being the sum of the products, or

$$p = \frac{w_{I}\ n}{l} + \frac{w_{II}\ s}{l} \qquad (16)$$

$$\text{and } q = \frac{w_{I}\ m}{l} + \frac{w_{II}\ r}{l} \qquad (17)$$

As a check add the two reactions together and their sum must equal the whole load, that is

$$p + q = w_{I} + w_{II}$$

Example.

A beam 9′ 2″ long between bearings carries two loads, one of 200 lbs. 4′ 2″ from the left-hand support, and the other of 300 lbs. 3′ 4″ from the right-hand support. What are the right-hand and left-hand reactions?

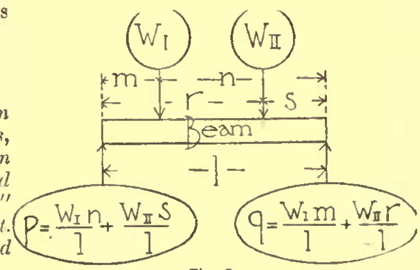


Fig. 8.

Referring to Figure 8 we should have w_{I} = 200 lbs., and w_{II} = 300 lbs., further $l = 110''$; $m = 50''$; $n = 60''$; $s = 40''$, and $r = 70''$, therefore the left-hand reaction would be: —

$$p = \frac{200.\ 60}{110} + \frac{300.\ 40}{110} = 218\tfrac{2}{11} \text{ pounds.}$$

and the right-hand reaction would be: —

$$q = \frac{200.\ 50}{110} + \frac{300.\ 70}{110} = 281\tfrac{9}{11} \text{ pounds.}$$

As a check add p and q together, and they should equal the whole load of 500 lbs., and we have in effect: —

$$p + q = 218\tfrac{2}{11} + 281\tfrac{9}{11} = 500 \text{ pounds.}$$

If the load on a beam is uniformly distributed, or is concentrated at the centre of the beam, or is concentrated at several points along the beam, each half of beam being loaded similarly, then each support will react just one half of the total load.

THE PRINCIPLE OF MOMENTS.

Law of Lever. The law of the lever is well known. The distance of a force from its fulcrum or point where it takes effect is called its *leverage*. The *effect* of the force at such point is equal to the amount of the force multiplied by its leverage.

Moment of a force. The *effect* of a force (or load) at any point of a beam is called the *moment* of the force (or load) at

[1] Continued from No. 545, page 271.

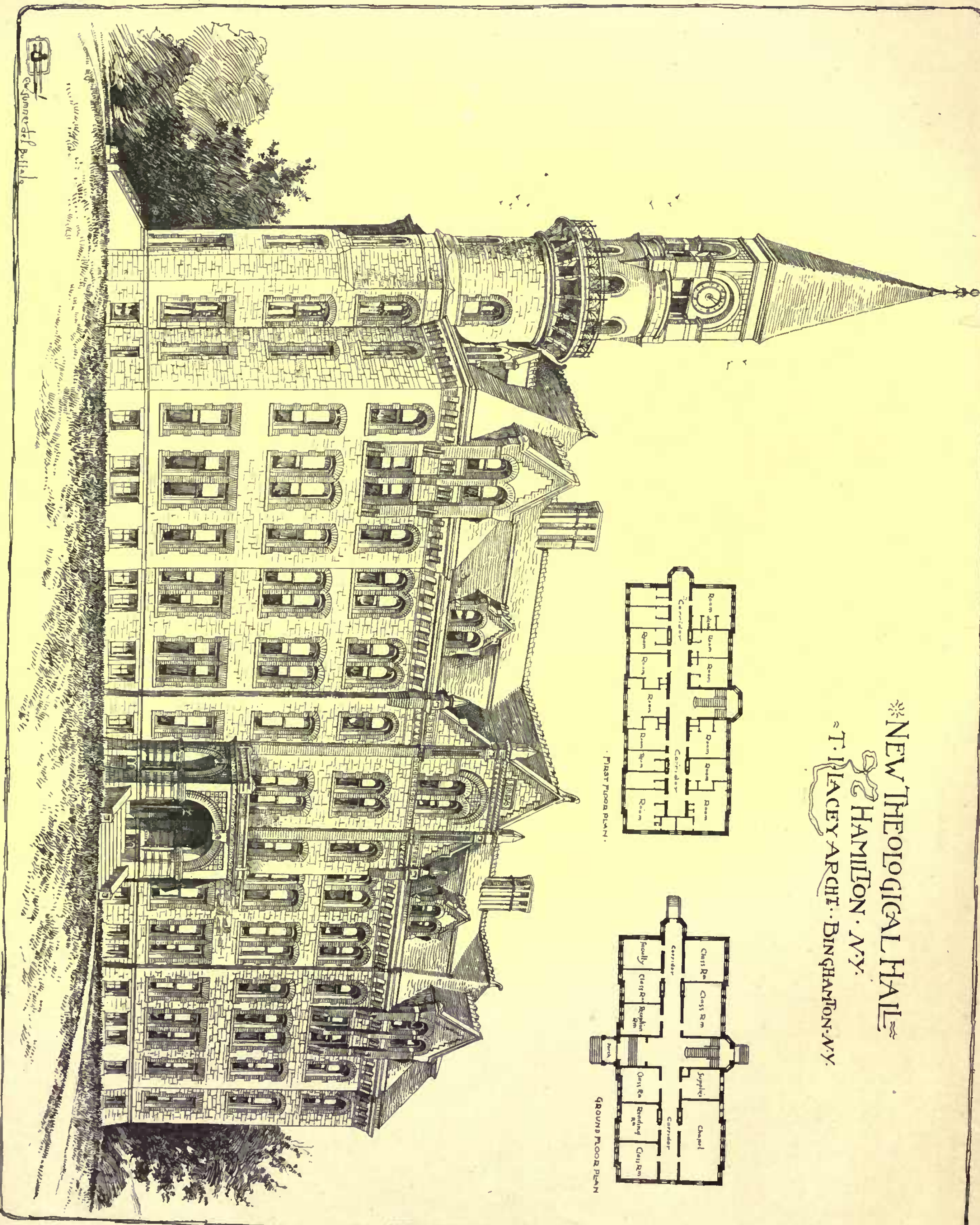
GLOSSARY OF SYMBOLS.—The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.: —

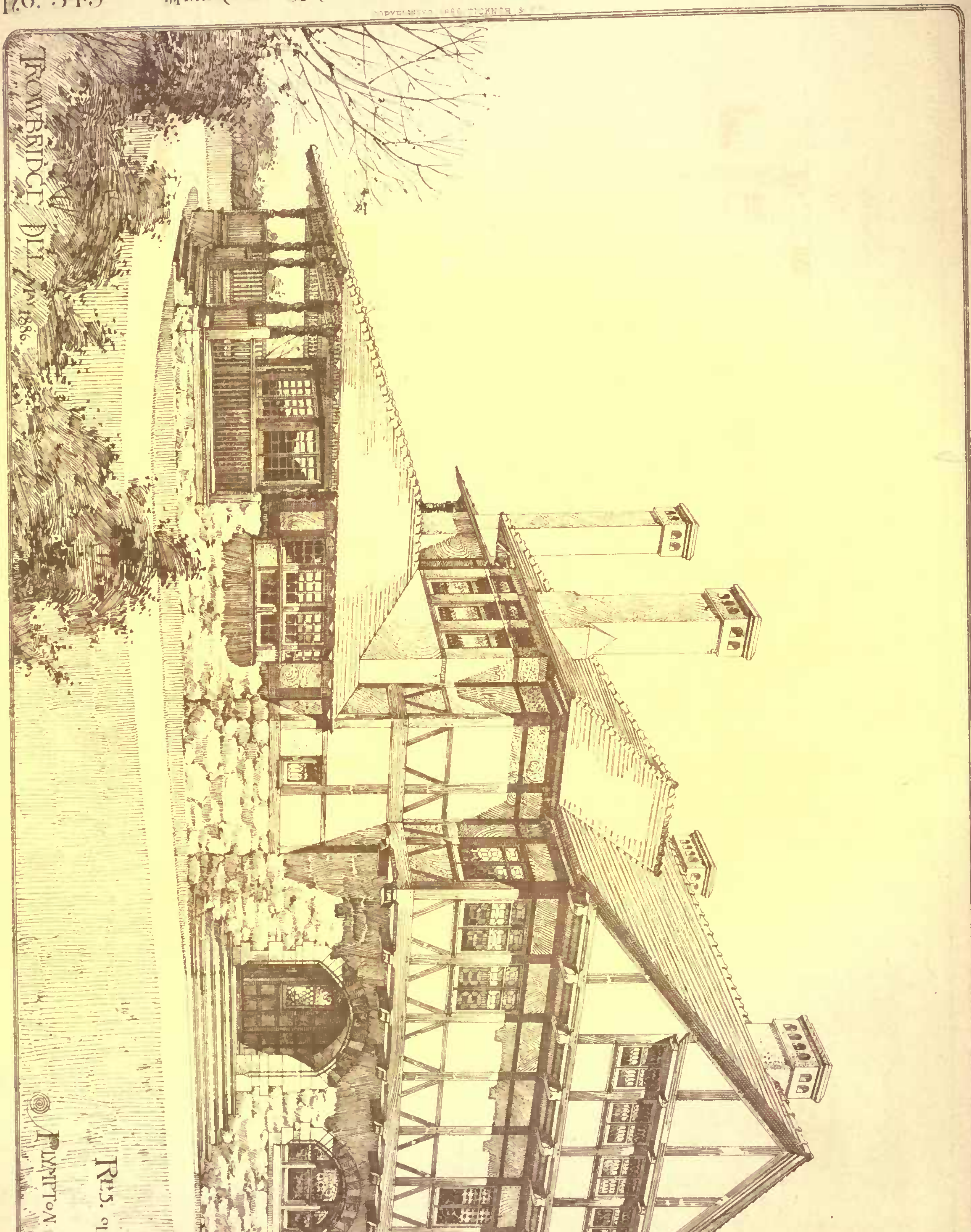
a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
f = *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g_{I} = constant for *ultimate resistance to shearing*, per square inch, longthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches. [See Table I.]
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of iong pillars. [See Table I.]
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right-hand re-action* (or support) of beams, in pounus.
r = *moment of resistance*, in inches. [See Table I.]
s = *strain*, in ponnds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
𝔡 = *diameter*, in inches.
𝔯 = *radius*, in inches.
π = 3.14159, or, say, 3.1-7 signifies the *ratio of the circumference and diameter of a circle*.

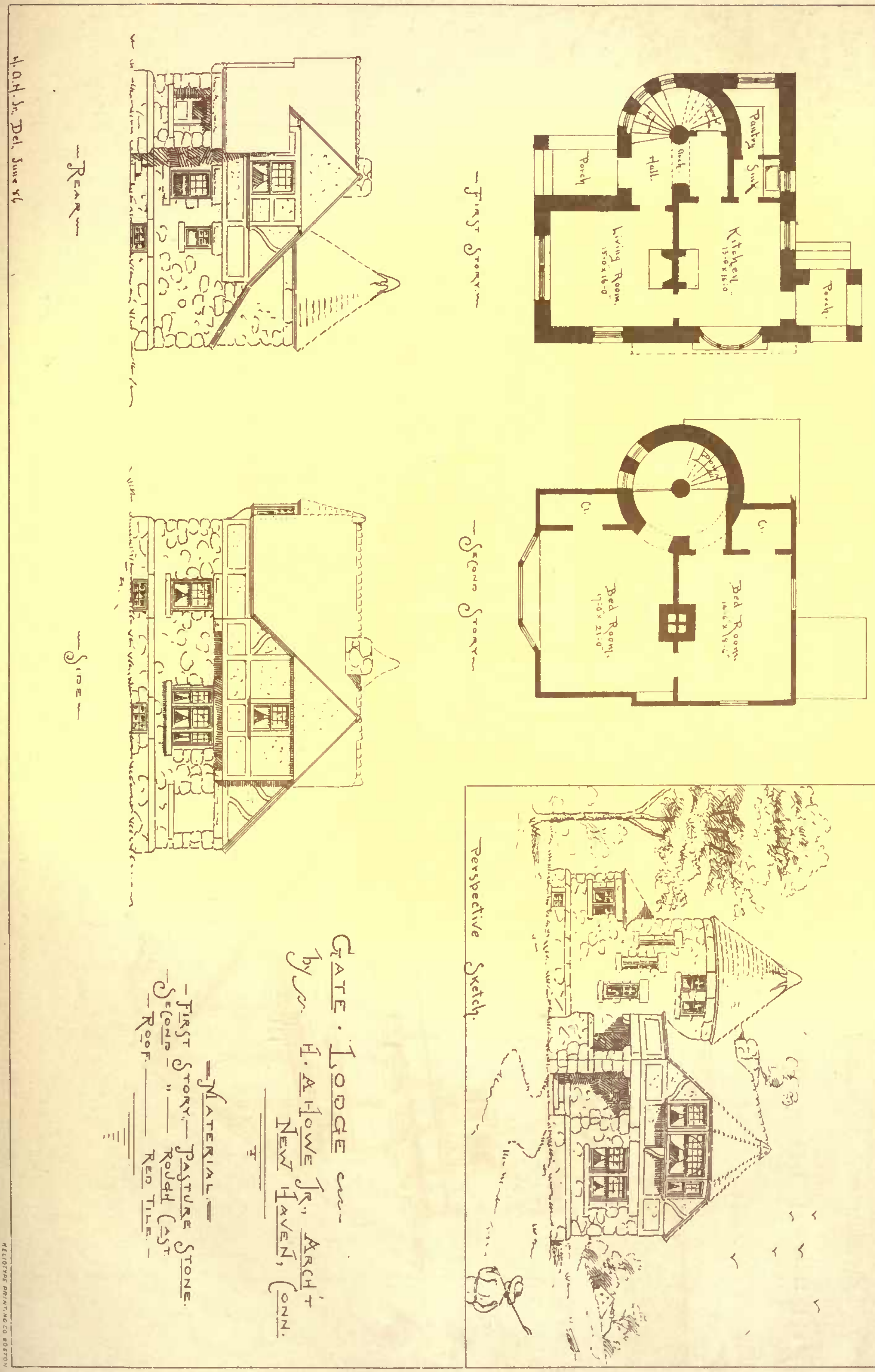
If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_{I}, a_{II}, a_{III}, etc., or b, b_{I}, b_{II}, b_{III}, etc.

In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance: —

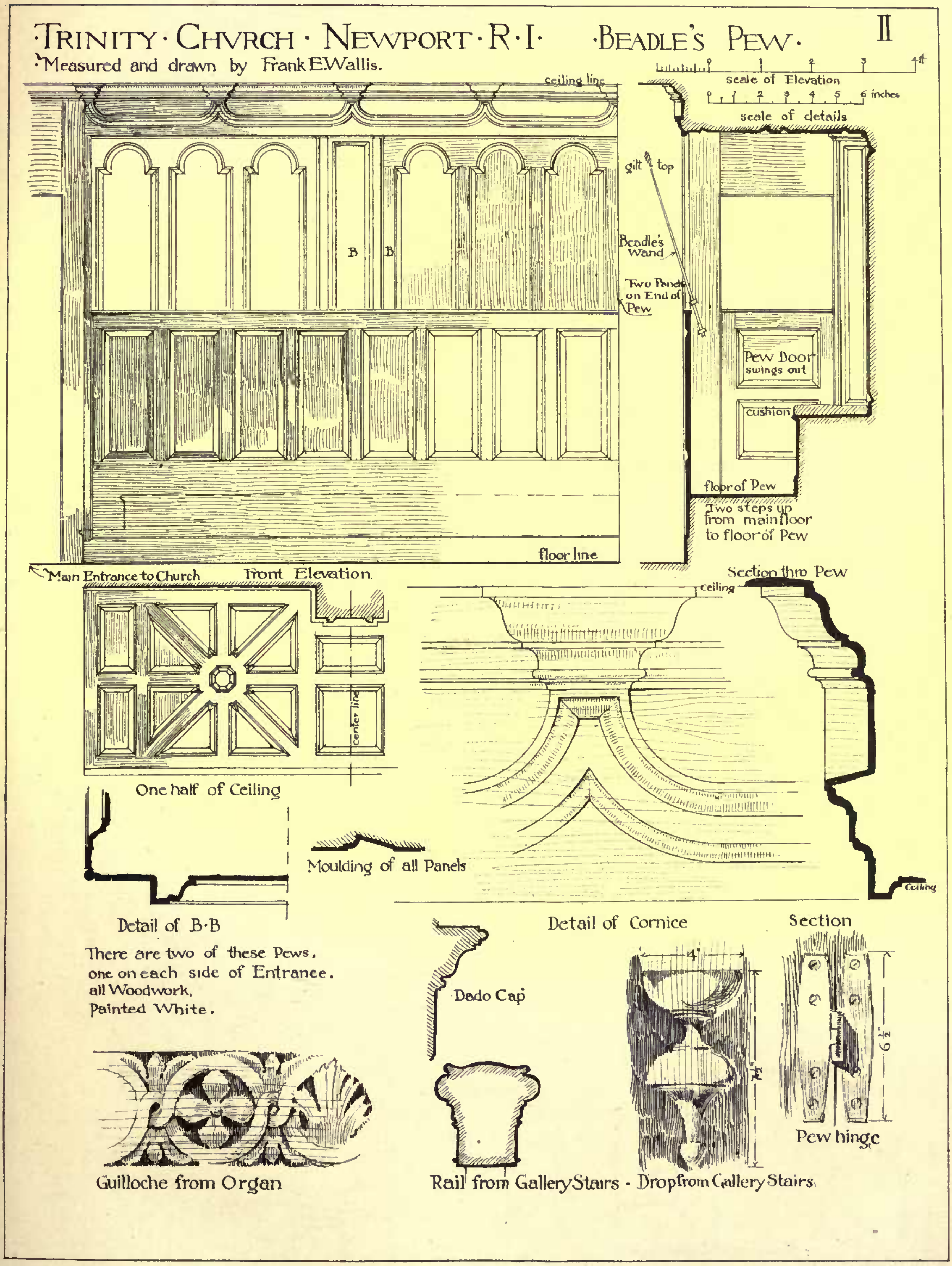
m = moment or bending moment at *centre*.
m_A = " " " *point A*.
m_B = " " " *point B*.
m_X = " " " *point X*.
s = strain at *centre*.
s_B = " *point B*.
s_X = " *point X*.
v = stress at *centre*.
v_D = " *point D*.
v_X = " *point X*.
w = load at *centre*.
w_A = " *point A*.


NEW THEOLOGICAL HALL
HAMILTON · N.Y.
T. I. LACEY ARCHT. · BINGHAMTON · N.Y.
FIRST FLOOR PLAN
GROUND FLOOR PLAN
HELIOTYPE PRINTING CO. BOSTON


Trowbridge Del. Mr 1886.
Res. of H. C. Hulbert
Clifton, O.
Plympton & Trowbridge Archts Cin. O.
Heliotype Printing Co Boston



H.A.H. Jr. Del. June '86
— REAR —
— SIDE —
— FIRST STORY —
Porch
Hall
Arch
Pantry
Sink
Living Room
Kitchen
Porch
— SECOND STORY —
Cl.
Cl.
Bed Room
Bed Room
Perspective Sketch.
GATE · LODGE
by H. A. Howe Jr., Arch't
New Haven, Conn.
— MATERIAL —
— First Story — Pasture Stone.
— Second " — Rough Cast.
— Roof — Red Tile. —



OLD COLONIAL WORK, X.

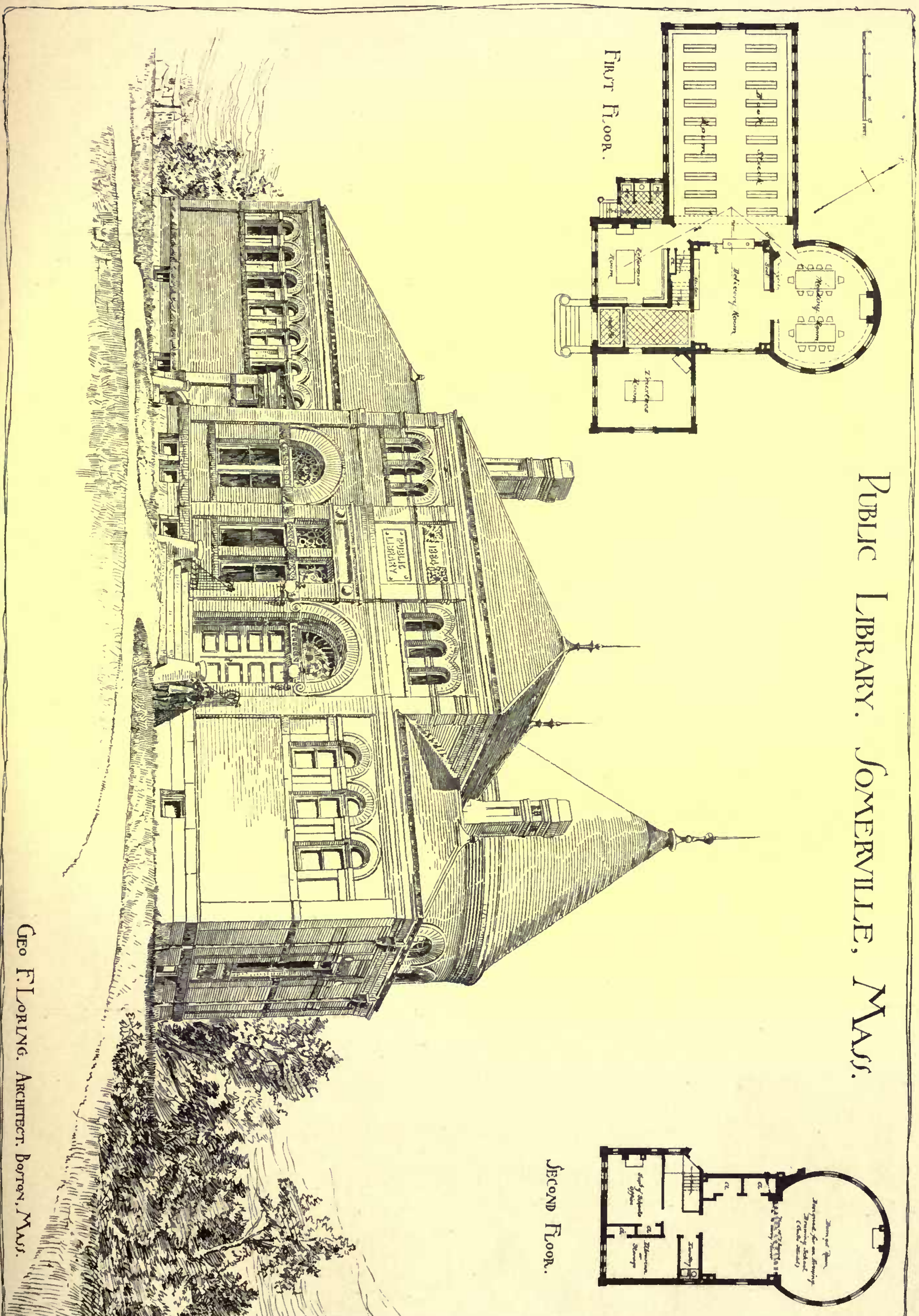

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TABLE IV.

STRENGTH OF MATERIALS PER SQUARE INCH.

WOODS.	Compression. Ultimate c	Compression. Safe $\frac{c}{f}$	Tension. Ultimate t	Tension. Safe $\frac{t}{f}$	Shearing. Ultimate g or g_1	Shearing. Safe $\frac{g}{f}$ or $\frac{g_1}{f}$	Modulus of Rupture. Ultimate k	Modulus of Rupture. Safe $\frac{k}{f}$	Modulus of Elasticity. e	Weight per Cubic ft.
Acacia	—	—	11000	1100	—	—	7000	1400	1150000	48
Alder	6900	700	9500	1000	—	—	4000	800	800000	38
Apple	—	—	13000	1300	—	—	4500	900	—	50
Ash, English	8000	800	10500	1000	—	—	7800	1300	1200000	48
" American	8000	800	11000	1100	g_1 = 650	65	8000	1350	1250000	40
" " across	2060	200	—	—	g = 6000	600	—	—	—	—
" Canadian	5000	500	6500	650	g_1 = 1400	140	5000	850	1000000	38
Bamboo	—	—	6000	600	—	—	—	—	—	25
Baywood	7200	720	10500	1000	—	—	—	—	—	—
Beech	8000	800	8000	800	g = 5000	500	6000	1000	1350000	48
Birch, English	5000	500	10000	1000	—	—	6000	1000	1250000	47
" American	8500	850	10000	1000	g_1 = 650	65	5800	950	1300000	43
" " across	1800	180	—	—	g = 5600	560	—	—	—	—
Box	10000	1000	15000	1500	—	—	7500	1250	2000000	62
Cedar	6000	600	8000	800	—	—	7000	800	500000	41
" across	1950	200	—	—	g = 1400	140	—	—	—	—
Cherry	8000	800	—	—	—	—	4500	900	1200000	40
" across	2400	240	—	—	g = 2900	290	—	—	—	—
Chestnut, American	5300	530	8500	850	g_1 = 700	70	5400	900	750000	41
" " across	840	84	—	—	g = 1500	150	—	—	—	—
" English	—	—	10000	1000	—	—	8000	800	1000000	38
Crab	6800	680	—	—	—	—	4500	750	—	—
Deal	6000	600	8500	850	g_1 = 625	60	4800	800	—	30
Ebony	18000	1800	18000	1800	g = 7500	750	18000	2000	—	76
Elder	8700	870	10000	1000	—	—	4500	900	—	43
Elm, English	8000	800	8000	800	g_1 = 1200	120	5000	800	700000	35
" " accoss	—	—	—	—	g = 3000	300	—	—	—	—
" Canadian	8500	850	9000	900	g_1 = 1400	140	9000	900	2000000	47
" " across	—	—	—	—	g = 5000	500	—	—	—	—
Fir, Riga	6000	600	7500	750	—	—	7000	700	870000	40
" New England	6700	670	7500	750	g_1 = 690	70	4000	800	1000000	40
" " across	1200	120	690	70	—	—	—	—	—	—
Greenheart	13000	1300	8000	800	—	—	9500	950	1500000	65
Gum	7000	700	10500	1000	5900	800	6000	900	1400000	62
Hazel	—	—	12000	1200	—	—	—	—	—	—
Hawthorn	—	—	7500	750	—	—	—	—	—	—
Hemlock	4500	450	7000	700	g_1 = 500	50	4500	750	800000	26
" **across**	500	50	550	55	g = 2750	275	—	—	—	—
Hickory, American	9500	1000	10000	1000	—	—	8000	1000	1100000	50
" " across	3000	300	—	—	g = 6500	650	—	—	—	—
Holly	5250	525	10500	1000	—	—	4500	900	—	—
Hornbeam	6600	660	14000	1400	—	—	6000	1000	750000	47
Jugeb	—	—	12500	1250	—	—	—	—	—	—
Lancewood	—	—	18000	1800	—	—	—	—	—	52
Larch	4500	450	7000	700	g_1 = 1300	130	5500	700	1000000	35
" across	1300	130	1300	130	g = 3000	300	—	—	—	—
Lignum-vitæ	9900	1000	10000	1000	—	—	8000	1000	1080000	62
Locust, American	10000	1000	12000	1200	g_1 = 1150	120	10000	1100	1500000	46
" " across	3000	300	—	—	g = 7200	720	—	—	—	—
Mahogany	8200	820	11000	1100	—	—	6000	1000	1200000	43
" across	2400	240	—	—	—	—	—	—	—	—
Maple	6500	650	8000	800	g_1 = 450	45	7000	700	877000	45
" across	1875	200	—	—	g = 6000	600	—	—	—	—
Oak, American, Red	6000	600	8000	800	g_1 = 750	75	6500	800	1200000	52
" " **White**	7200	720	11000	1100	g_1 = 800	80	7200	1100	900000	52
" " " **across**	2400	240	2300	230	g = 4400	440	—	—	—	—
" Black bog	—	—	7700	770	—	—	—	—	—	—
" Canadian	6000	600	7500	750	—	—	7000	750	—	54
" Dantzic	7500	750	6000	600	g = 2300	230	6000	800	1165000	47
" English	8300	830	12000	1200	g_1 = 2316	230	6800	1100	873000	54
" " across	1800	200	2400	240	g = 4000	400	—	—	—	—
" Live	6850	700	11000	1100	g_1 = 700	70	7300	1100	—	69
" " across	4500	450	—	—	g = 8500	850	—	—	—	—
Pear	7500	750	8000	800	—	—	3400	700	800000	42
Pine, American yellow	5400	540	9000	900	—	—	6000	800	1100000	34
" " " across	—	—	—	—	g = 4800	500	—	—	—	—
" " red	6500	650	9000	900	g_1 = 650	65	6100	800	900000	36
" " white	5500	550	9000	900	g_1 = 450	45	4000	900	850000	28
" " " across	700	70	550	60	g = 2500	250	—	—	—	—
" Canadian yellow	5300	530	6000	600	g_1 = 350	40	4800	600	1000000	33
" " " across	1425	150	—	—	g = 4300	430	—	—	—	—
" **Georgia yellow**	7400	750	12000	1200	g_1 = 500	50	7200	1200	1200000	48

WOODS.	Compression. Ultimate c	Compression. Safe $\frac{c}{f}$	Tension. Ultimate t	Tension. Safe $\frac{t}{f}$	Shearing. Ultimate g or g_1	Shearing. Safe $\frac{g}{f}$ or $\frac{g_1}{f}$	Modulus of Rupture. Ultimate k	Modulus of Rupture. Safe $\frac{k}{f}$	Modulus of Elasticity. e	Weight per Cubic ft.
Pine, Georgia Yel'w across	1850	200	—	—	g = 5700	570	—	—	—	—
" Pitch	8900	900	10000	1000	g_1 = 510	50	6600	1000	1225000	65
" " across	—	—	—	—	g = 5000	500	—	—	—	—
Plum	9000	900	8000	800	—	—	7000	900	—	45
Poon	—	—	9000	900	—	—	8000	900	1600000	—
Poplar (white wood)	5000	500	5500	550	g_1 = 400	40	4500	600	762000	27
" across	1000	100	1800	180	g = 4400	440	—	—	—	—
Redwood, California	6000	600	7300	750	—	—	4500	750	—	13
Spruce	6500	650	10000	1000	g_1 = 400	40	4400	1000	850000	30
" **across**	750	75	550	60	g = 3600	360	—	—	—	—
Sycamore	8100	810	10000	1000	—	—	6000	1000	1000000	40
Teak	12000	1200	14000	1400	—	—	8000	1300	1400000	46
Walnut	7000	700	8000	800	—	—	5500	800	900000	39
Walnut across	2100	210	—	—	g = 4000	400	—	—	—	39
Willow	6000	600	8500	850	—	—	4500	800	566000	25
Yew	—	—	6000	600	—	—	7000	700	—	50
METALS.										
Aluminium bronze	130000	25000	73000	12000	—	—	—	—	—	—
Antimony, cast	—	—	1100	200	—	—	—	—	—	418
Bismuth	—	—	3200	500	—	—	—	—	—	614
Brass, yellow, cast	80000	8000	28000	4500	37000	6000	20000	5000	9000000	506
" wire, unannealed	—	—	80000	8000	—	—	—	—	14000000	530
" " annealed	—	—	50000	5000	—	—	—	—	—	—
Bronze, gun-metal	120000	25000	32000	8000	—	—	53000	12500	10000000	529
" wire, unannealed	—	—	150000	30000	—	—	—	—	10000000	520
" " annealed	—	—	63000	13000	—	—	—	—	—	—
Copper, pure cast	117000	25000	30000	10000	33000	11000	22000	7000	10000000	543
" cast	—	—	25000	8000	—	—	—	—	—	—
" sheet wrought	103000	21000	34000	11000	—	—	—	—	15000000	556
" wire, unannealed	—	—	63000	20000	—	—	—	—	18000000	—
" " annealed	—	—	36000	12000	—	—	—	—	—	—
" bolts	—	—	32000	11000	—	—	—	—	—	556
Gold, cast	—	—	20000	5000	—	—	—	—	—	1204
" wire, unannealed	—	—	30000	7500	—	—	—	—	—	1217
" " annealed	—	—	5000	1250	—	—	—	—	—	—
Iron, cast, Am., 1" thick	85000	15000	16500	2500	18000	2600	40000	6000	15000000	454
" " English	70000	13000	13000	2000	14000	2000	36000	4000	12000000	450
" **wrought, American**	47000	12000	50000	12000	40000	8000	43000	12000	27000000	483
" " English	35000	9000	45000	11000	36000	7000	34000	10000	26000000	480
" corrugated	—	—	—	—	—	—	46000	10000	—	—
" wire ropes, unannealed	—	—	80000	20000	—	—	—	—	25300000	480
" " " annealed	—	—	50000	12000	—	—	—	—	15000000	—
" chains	—	—	35000	9000	—	—	—	—	—	—
" welded with steel, 5 ply	—	—	55500	14000	—	—	—	—	—	—
Lead, sheet	—	—	2500	500	—	—	—	—	—	—
" cast	7700	1200	2000	400	—	—	—	—	720000	712
" drawn pipe	—	—	1700	350	—	—	—	—	—	709
" wire	—	—	1400	300	—	—	—	—	—	—
Mercury at 32°	—	—	—	—	—	—	—	—	—	851
Nickel	—	—	—	—	—	—	—	—	—	488
Palladium, wire	—	—	50000	10000	—	—	—	—	—	—
" drawn	—	—	26000	5200	—	—	—	—	—	—
" annealed	—	—	7100	1500	—	—	—	—	—	—
Pewter	—	—	—	—	—	—	—	—	—	453
Platinum, wire, unannealed	—	—	55000	11000	—	—	—	—	—	1350
" " annealed	—	—	25000	5000	—	—	—	—	—	1379
Plumbago	—	—	—	—	—	—	—	—	—	142
Silver, cast	—	—	41000	8000	—	—	—	—	—	655
" annealed	—	—	4300	900	—	—	—	—	—	658
" wire, unannealed	—	—	38000	7600	—	—	—	—	—	—
Solder, soft	—	—	7500	1200	—	—	—	—	—	—
Steel, American, wrought	90000	15000	108000	18000	75000	12000	100000	15000	29000000	488
" English	—	—	95000	15000	65000	10000	80000	13000	28000000	490
" wire, unannealed	—	—	160000	25000	—	—	—	—	—	490
" " annealed	—	—	80000	13000	—	—	—	—	—	—
" rope, galvanized	—	—	6700	1200	—	—	—	—	—	—
" chains	—	—	42000	8500	—	—	—	—	—	—
" cast	150000	25000	85000	15000	57000	10000	125000	15000	30000000	—
" welded hard & soft, 5 ply	—	—	63300	15000	—	—	—	—	—	—
Tin, cast	15500	2500	5500	1000	—	—	4000	1000	4000000	462
" wire	—	—	7000	1200	—	—	—	—	—	—

TABLE IV. (*Continued.*)

STRENGTH OF MATERIALS PER SQUARE INCH.

MISCELLANEOUS.	Compression. Ultimate c	Compression. Safe $\frac{c}{f}$	Tension. Ultimate t	Tension. Safe $\frac{t}{f}$	Shearing. Ultimate g or g_1	Shearing. Safe $\frac{g}{f}$ or $\frac{g_1}{f}$	Modulus of Rupture. Ultimate k	Modulus of Rupture. Safe $\frac{k}{f}$	Modulus of Elasticity. e	Weight per Cubic ft.
Zinc, sheet	—	—	12000	2000	—	—	—	—	13500000	449
" wire	—	—	20000	3300	—	—	—	—	—	—
" cast	40000	7000	3300	600	—	—	7500	1200	—	438
MISCELLANEOUS.										
Bone	—	—	5000	500	—	—	—	—	—	—
Cement, Portland	3000	300	500	50	—	—	900	90	800000	81
Glass, common green	28000	1500	2850	300	—	—	4000	400	8000000	173
" crystal	17000	1000	2413	240	—	—	—	—	5800000	157
" flint	25000	1400	2300	230	—	—	—	—	—	—
" white crown	30000	1600	2500	250	—	—	—	—	—	—
" plate	—	—	5000	500	—	—	—	—	—	—
Ice, 32°	230	20	—	—	—	—	—	—	6000000	57
Ivory	—	—	16000	1600	—	—	—	—	—	114
Limestone	7000	700	1000	100	—	—	1500	150	3300000	146
Marble, Italian	12000	1200	700	70	—	—	2080	200	2500000	168
Mortar, lime	400	100	50	5	—	—	125	12	1285000	98
" Portland cement	2000	200	300	30	—	—	700	70	600000	109
Ox leather	—	—	4200	400	—	—	—	—	240000	—
Portland stone	3500	350	900	90	—	—	1530	150	1600000	146
Silk fibre	—	—	5200	520	—	—	—	—	1300000	—
Skin, ox undressed	—	—	6300	600	—	—	—	—	—	—
Slate	11000	1100	10000	800	—	—	5000	500	12000000	160
Ropes, hempen	—	—	8000	800	—	—	—	—	—	—
Whalebone	—	—	7700	770	—	—	—	—	820000	81
Yarn, flaxen	—	—	25000	1500	—	—	—	—	—	—

TABLE V.

STRENGTH OF STONES, BRICKS, AND CEMENTS PER SQUARE INCH.

STONES.	Compression on bed. Ultimate c	Compression on bed. Safe $\frac{c}{f}$	Compression on edge. Ultimate c_1	Compression on edge. Safe $\frac{c_1}{f}$	Tension. Ultimate t	Tension. Safe $\frac{t}{f}$	Modulus of Rupture. Ultimate k	Modulus of Rupture. Safe $\frac{k}{f}$	Weigh per Cubic ft.
Bluestone	13500	1350	—	—	1400	140	2300	230	160
Granite, average	15000	1500	—	—	580	50	1860	180	170
" Aberdeen (Scotch)	10700	1000	—	—	—	—	—	—	165
" Blue, Staten Island, N. Y	22250	2000	—	—	—	—	1300	130	179
" Canadian	12000	1200	—	—	—	—	—	—	162
" Connecticut	12000	1200	13000	1300	—	—	—	—	166
" Cornish (English)	6300	630	—	—	—	—	—	—	183
" Keene, N. H	14500	1450	—	—	—	—	1500	150	—
" Kingston (Dublin), Ireland	10450	1050	—	—	—	—	—	—	171
" Maine	15000	1500	15000	1500	—	—	—	—	168
" Massachusetts	16000	1600	9250	925	—	—	1870	180	165
" Millstone Point	15700	1570	—	—	—	—	1900	190	—
" Mt. Sorrel	12900	1300	—	—	—	—	—	—	—
" New Jersey	22000	2200	—	—	—	—	—	—	189
" New York State	15000	1500	15000	1500	—	—	—	—	168
" Peterhead (Scotch)	8300	830	—	—	—	—	—	—	166
" Virginia	14000	1400	—	—	—	—	—	—	164
" Greenstone, Giants' Causeway, Ireland	18000	1800	—	—	—	—	—	—	—
Limestone, average	7000	700	6000	600	1000	100	1500	150	146
" Anglesea, English	7600	760	—	—	—	—	—	—	—
" Bath, English	1450	150	—	—	—	—	370	37	—
" Caen, French	3550	350	—	—	150	15	600	60	119
" Chalk, average	1000	100	—	—	118	10	670	50	145
" Chilmark, English	3240	325	—	—	500	50	—	—	153
" Canton, Mo., drab	7200	720	—	—	—	—	—	—	146
" Marquette, Mich., drab	7900	790	7800	780	—	—	—	—	146
" Dublin, Irish	17000	1700	—	—	—	—	—	—	—
" English, compact	8300	830	—	—	—	—	800	80	160
" Glen Falls, N. Y.	11500	1100	10750	1000	—	—	—	—	169
" Lake Champlain, N. Y.	25000	2000	21500	1800	—	—	—	—	172
" North River, N. Y.	17000	1500	14150	1400	—	—	—	—	166
" Purbeck (hard bed), English	8000	800	—	—	—	—	—	—	153

TABLE V. (*Continued.*)

STRENGTH OF STONES, BRICKS, AND CEMENTS PER SQUARE INCH.

STONES.	Compression on bed. Ultimate c	Compression on bed. Safe $\frac{c}{f}$	Compression on edge. Ultimate c_1	Compression on edge. Safe $\frac{c_1}{f}$	Tension. Ultimate t	Tension. Safe $\frac{t}{f}$	Modulus of Rupture. Ultimate k	Modulus of Rupture. Safe $\frac{k}{f}$	Weight per Cubic ft.
Limestone, Portland, English	3500	350	—	—	900	90	1530	150	146
" Joliet, Ill., white	13000	1300	7050	700	—	—	—	—	159
" Marblehead, Ohio, white	11500	1150	—	—	—	—	—	—	152
Marble, average	8000	800	8000	800	700	70	1200	120	160
" Devonshire red (English)	7300	730	—	—	—	—	—	—	163
" Eastchester	13000	1300	—	—	1600	160	1900	190	179
" Illinois	9700	970	9800	980	1000	100	1200	120	159
" Italian	12000	1200	—	—	700	70	2080	200	168
" Vermont	7600	760	8670	870	675	67	1200	120	166
Rock, average	12000	1000	11000	1000	—	—	—	—	165
" quartz (American)	22000	1500	13000	1000	—	—	—	—	165
" Holyhead (English)	25000	1500	13700	1000	—	—	—	—	165
" hard, New York City	11250	1000	12500	1000	—	—	—	—	182
Sandstone, average	5000	500	—	—	150	15	1000	100	144
" Berlin, Ohio	14250	1000	12000	1000	—	—	—	—	—
" Belville, N. J. (brown)	11700	1000	10250	800	—	—	650	50	141
" Corsehill (red Scotch)	7760	700	—	—	—	—	—	—	154
" Gatelawbridge (red Scotch)	8500	750	—	—	—	—	—	—	152
" Little Falls, N. Y. (brown)	9850	980	9150	900	—	—	1730	170	140
" Craigleith (Scotch)	5500	550	—	—	450	45	770	77	144
" Longmeadow, (Worcester) brown	10300	1000	—	—	—	—	—	—	142
" Longmeadow, (Kibbe) red	12700	1200	—	—	—	—	—	—	149
" Middletown, Conn. (brown)	6950	600	5550	500	590	50	1000	100	148
" Amherst, Ohio (brown-gray)	6000	600	5450	500	105	10	—	—	135
" Bramley Falls, English	5900	550	—	—	—	—	—	—	142
" Dorchester, Nova Scotia (freestone)	9200	900	—	—	100	10	800	80	150
" " (olive)	4250	400	6050	600	—	—	—	—	150
" Drab Berea (Ohio)	8750	800	—	—	105	10	—	—	134
" Runcorn red, (English)	2100	200	—	—	—	—	—	—	129
" Yorkshire paving (English)	5600	500	—	—	—	—	750	75	166
Slate	11000	1100	—	—	10000	800	5000	500	160
Whinstone (Scotch)	8100	800	—	—	1450	140	—	—	—
Stonework	with	level,	dressed	beds	allow	4-10 of	strength	of	stone.
Rubblework	600	100	—	—	—	—	—	—	150
BRICKS.									
Bricks, light red	640	65	—	—	40	4	—	—	—
" good common	10000	800	—	—	200	20	600	60	100
" best hard	12000	1000	—	—	400	40	750	75	107
" Philadelphia, pressed	6000	600	—	—	—	—	650	65	105
" brown glazed (English)	1300	130	—	—	—	—	—	—	—
" fire (English)	1700	170	—	—	—	—	—	—	138
Brickwork, common	1000	100	—	—	50	5	—	—	110
" good	1500	150	—	—	100	10	—	—	111
" best, in cement mortar	2000	200	—	—	300	30	—	—	112
Terra-cotta	5000	400	—	—	—	—	—	—	110
Terra-cotta work	2000	200	—	—	—	—	—	—	112
CEMENTS, ETC.									
Cement, Rosendale	1500	150	—	—	290	29	400	40	56
" Portland	3000	300	—	—	500	50	900	90	81
" lime	600	60	—	—	—	—	200	20	59
" plaster-of-Paris	600	60	—	—	70	7	—	—	78
Mortar, lime	400	100	—	—	50	5	125	12	98
" lime and Rosendale	550	125	—	—	75	8	200	20	100
" Rosendale cement	700	150	—	—	145	15	300	30	102
" Portland cement	2000	200	—	—	300	30	700	70	109
" plastering	400	50	—	—	—	—	—	—	86
Concrete, Portland cement	1500	200	—	—	427	40	162	16	150
" Rosendale cement	400	100	—	—	100	10	66	8	140
SOILS.									
Clay, horizontal layers	—	40	—	—	—	—	—	—	120
Firm earth	—	20	—	—	—	—	—	—	115
Gravel, firm with earth	—	100	—	—	—	—	—	—	125
Loam, soft	—	10	—	—	—	—	—	—	110
Sand, solid dry	—	[illegible]	—	—	—	—	—	—	112

TABLE VI.
WEIGHT PER CUBIC FOOT OF MATERIALS.
(Not Included in Tables IV and V.)

Material.	Weight.	Material.	Weight.
Ashes	59	Peat	85
Asphalt	150	Petrified wood	145
Butler	60	Pitch	75
Camphor	63	Plumbago	131
Charcoal	23	Pumice-stone	56
Coal, solid	93	Resin	68
" loose	54	Rock crystal	172
Coke	50	Rubber	62
Cork	15	Salt	134
Cotton in bales	20	Saltpetre	130
Fat	58	Snow, fresh fallen	6
Gunpowder	56	" solid	20
Hay in bales	17	Sugar	82
Isinglass	70	Sulphur	125
Lead, red	560	Tiles	115
Paper	55	Water	63

said point, and is equal to the amount of the force (or load) multiplied by the distance of the force (or load) from said point, *the distance measured at right angles to the line of the force.* If therefore we find the moments — for all of the forces acting on a beam — at any single point of the beam we know the total moment at said point, and this is called the *bending-moment* at said point. Of course, forces acting in opposite directions will give opposite moments, and will counteract each other; to find the bending-moment, therefore, for any single point of a beam take the difference between the sums of the opposing moments of all forces acting at that point of the beam.

Bending moment.

Now on any loaded beam we have two kinds of forces, the loads which are pressing downwards, and the supports which are resisting upwards (theoretically *forcing* upwards). Again, if we imagine that the beam will break at any certain point, and imagine one side of the beam to be *rigid*, while the other side is tending to break away from the rigid side, it is evident that the effect at the point of rupture will be from one side only; therefore we must take the forces on *one side* of the point *only*. It will be found in practice that no matter for what point of a beam the bending moment is sought, the bending moment will be found to be the same, whether we take the forces to the right side or left side of the point. This gives an excellent check on all calculations, as we can calculate the bending moment from the forces on each side, and the results of course should be the same.

Now to find the actual strain on the fibres of any cross-section of the beam, we must find the bending moment at the point where the cross-section is taken, and divide it by the moment of resistance of the fibre, or,

$$\frac{m}{r} = s$$

Where $m =$ the bending moment in lbs. inch.
Where $r =$ the moment of resistance of the fibre in inches.
Where $s =$ the strain.

The stress, of course, will be equal to the resistance to cross-breaking the fibres are capable of. In the case of beams which are of uniform cross-section above and below the neutral axis, this resistance is called the Modulus of Rupture (k). It is found by experiments and tests for each material, and will be found in Tables IV and V. We have, then, for *uniform cross-sections:* —

$$v = k$$

Where $v =$ the ultimate stress per square inch.
Where $k =$ the modulus of rupture per square inch. Inserting this and the above in the fundamental formula (1), viz.: $v = s.f.$, we have: —

$$k = \frac{m}{r} . f, \text{ or}$$

Transverse strength uniform cross-section.

$$\frac{m}{\left(\frac{k}{f}\right)} = r \qquad (18)$$

Where $m =$ the bending moment in lbs. inch at a given point of beam.
Where $r =$ the moment of resistance in inches of the fibres at said point.
Where $\left(\frac{k}{f}\right) =$ the safe modulus of rupture of the material, per square inch.

Transverse strength section not uniform.

If the *cross-section is not uniform* above and below the neutral axis, we must make two distinct calculations, one for the fibres above the neutral axis, the other for the fibres below; in the former case the fibres would be under compression, in the latter under tension. Therefore, for the fibres *above the neutral axis*, the ultimate stress would be equal to the ultimate resistance of the fibres to compression, or $v = c$.

Inserting this in the fundamental formula (1), we have: —

$$c = \frac{m}{r} . f, \text{ or}$$

Upper fibres.

$$\frac{m}{\left(\frac{c}{f}\right)} = r \qquad (19)$$

Where $m =$ the bending moment in lbs. inch, at a given point of beam.
Where $r =$ the moment of resistance in inches of the fibres at said point.
Where $\left(\frac{c}{f}\right) =$ the safe resistance to crushing of the material, per square inch.

For the *fibres below the neutral axis*, the ultimate stress would be equal to the ultimate resistance of the fibres to tension, or, $v = t$.

Inserting this in the fundamental formula (1) we have: —

$$t = \frac{m}{r} . f, \text{ or}$$

Lower fibres.

$$\frac{m}{\left(\frac{t}{f}\right)} = r \qquad (20)$$

Where $m =$ the bending moment in lbs. inch at a given point of beam.
Where $r =$ the moment of resistance in inches of the fibres at said point.
Where $\left(\frac{t}{f}\right) =$ the safe resistance to tension of the material, per square inch.

The same formulæ apply to cantilevers as well as beams.

The moment of resistance r of any fibre is equal to the moment of inertia of the whole cross-section, divided by the distance of the fibre from the neutral axis of the cross-section.

Greatest strains on extreme fibres.

The greatest strains are along the upper and lower edges of the beam (the extreme fibres); we, therefore, only need to calculate their resistances, as all the intermediate fibres are nearer to the neutral axis, and, consequently, *less* strained. The distance of fibres chosen in calculating the moment of resistance is, therefore, the distance from the neutral axis of either the upper or lower edges, as the case may be. The moments of resistance given in the fourth column, of Table I, are for the upper and lower edges (the extreme fibres), and should be inserted in place of r, in all the above formulæ.

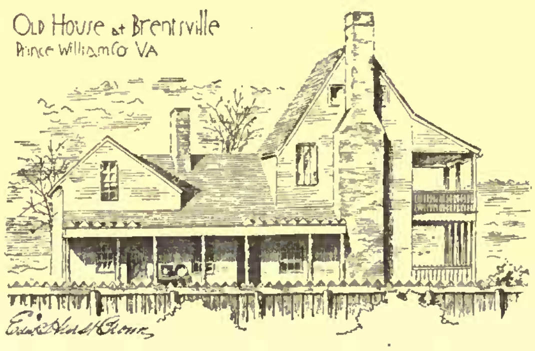
Point of greatest bending moment.

To find at what point of a beam the greatest bending moment takes place (and, consequently, the greatest fibre strains, also), begin at either support and move along the beam towards the other support, passing by load after load, until the amount of loads that have been passed is equal to the amount of the reaction of the support (point of start); the point of the beam where this amount is reached is the point of greatest bending moment.

In cantilevers (beams built in solidly at one end and free at the other end), the point of greatest bending moment is *always* at the point of the support (where the beam is built in).

In light beams and short spans the weight of the beam itself can be neglected, but in heavy or long beams the weight of the beam should be considered as an independent uniform load.

THE ASH.



THE value of the ash largely lies in its white or pale color, and as there are no objectionable qualities in the white sap-wood, it is naturally preferred. It is the toughest wood natural to Europe, and is only surpassed by lancewood and young hickory in imported woods. This is especially the case in young trees grown on suitable soils. In the south of Europe it is not a tree to be admired, and is rarely allowed to grow in the neighborhood of houses or villages, from the attraction it has to the cantharide or Spanish fly, a blistering beetle fully one inch long and one-quarter of an inch broad. Mr. Giles Munby states in the *Magazine of Natural History*, Vol. IX, page 119, that he saw an ash tree overhanging the road near Dijon so crowded with these flies, that the excrement of the insects literally blackened the ground. On passing underneath the tree he felt his face as if bitten by gnats, and smelt a most disagreeable sickening smell, which extended twenty or thirty yards from the tree, according to the direction of the wind.

PROPERTIES AND USES OF THE ASH.

In the field of commerce the ash is introduced at an early age. At four or five years' growth it is fit for walking-sticks, whip-handles, etc.; a year or two later as poles for lances and for hop-growing; and it is then ready for the cooper, the turner, the chair-maker, and the manufacturer of small wares. It is also used for hoops, crates, handles of baskets, handles for hammers, and other tools. In this young state it is called "maiden ash," an old and somewhat poetic name, for trees are invariably alluded to in the feminine.

Another and very tough form of the young ash is the "stooled" *i. e.*, the second growth from the original roots, a quality or form of reproduction that certain forest trees are endowed with.

The mature wood, except in the detail of size, possesses no special quality over the young or small wood; in neither form is it durable and free from the attack of worms (the larvæ of the furniture beetle), and hence it is never used as building timber. In this respect a marked distinction exists between the ash and the oak, the one being sweet and the other bitter in the secretionary matter forming the heartwood, and palatable or repulsive to animal life.

The uses to which large ash is applied is manifold. It is an important factor in the hands of the wheelwright and the agricultural-implement maker, as it has been from very ancient times; it is also largely used by the coachmaker and the carriage-builder. It is an admirable wood for chopping-blocks and shop-boards, and for all purposes where washing is required, as it will not readily splinter: it is also largely used for bobbins and tools, as trawl-beams for fishermen, and for numerous purposes in ship and boat building.

ASH AS COMPARED WITH OAK AND ELM.

The specific gravity of the ash is 736, the oak 827, and the elm 558. The elasticity of the ash is 1,289, the oak 1,000, and the elm 564. The following are the Admiralty tests on scantlings 2″ x 2″, placed on bearers 6 feet apart: —

The ash broke with 862 lbs., the oak with 837 lbs., and the elm with 393 lbs. The deflection at the crisis of breaking was: ash $8\frac{625}{1000}$ inches, oak, $7\frac{354}{1000}$ inches, and elm, $5\frac{291}{1000}$ inches.

It will thus be seen that the ash is lighter than the oak, but that it is stronger and more elastic. The elm, in comparison, occupies a very low position; but this is largely owing to the specimens operated upon being cut from matured wood, which was presumably in a dry state. Young elm or poles would compare much more favorably with ash, or otherwise we should not find them used in old times for bows or as substitutes for ash as trawl-beams in the fishing trade of to-day.

The great point in which the ash differs from the oak is in its durability; but this defect is largely overcome by keeping the wood well covered with paint. The worm is nevertheless its great enemy, and the dissolution of the wood at a very early stage, compared with the heart of oak, is largely traceable to its operations.

THE AMERICAN ASH.

This is the *Fraxinus Americana* of our botanists, an important tree, which abounds from Carolina to Canada, and is remarkable for the rapidity of its growth, often rising with a trunk 40 feet in length to the first branches, and a diameter of 3 feet. It prefers a cold climate, and location on the banks of rivers, or on the edges or acclivities of swamps.

It is commonly known in America as the "white ash," from the color of the bark, which is lighter than the English or European ash. In some instances it is called the "green ash," from the pale color of its leaves, especially when young.

The American ash grows well in Europe, and has the remarkable quality of being free from the attack of the Spanish fly, and may, in consequence, be planted with safety near dwelling-houses, where the European ash could not be tolerated; but, as with other trees of recent introduction, it is not so well known as its merits warrant.

The wood of the young trees or stools, being mostly sap-wood is white; but the heart-wood of mature trees, and hence that of imported logs, is reddish or inclined to brown in color.

The wood is used in one or other of its forms throughout America for all the purposes to which the European ash is applied in England; but when imported into this country the whitest logs are considered the best, and are much sought after by the cabinet-makers for bedroom furniture, the more colored logs being held as inferior, both in strength and durability, an impression that pervades the wood trade in general.

The American or Quebec ash, compared with oak and birch, is but sparingly imported into this country; it reaches us in partly-squared logs 18 to 30 feet long, 10 to 18 inches square, and latterly in the form of sawn planks.

The young or small wood being tough, is largely made into boat oars, and the quality being uniformly good renders them in active demand in Europe. In some cases these oars are shipped in a wrought form, the operation being performed by machinery, in others they come to hand in a rough-hewn state.

The mature wood, when compared with English ash, is fine and soft, and in consequence is taken up by the cabinet-maker for drawer and carcase works, branches of trade altogether strange to our native ash. When used for legitimate ash purposes it is accounted inferior to that of English growth.

One quality possessed by the American ash is that of standing well in work when once it is properly dried. In this respect it is very distinct from English ash, which is rarely, if ever, used for panel purposes by coach-builders or cabinet-makers. Another quality possessed by this wood is that of being easy to work, a great consideration where labor is a costly item.

It is clear from the above that, although it is used in America for all purposes to which European ash is applied in England, it is used for other purposes upon reaching this country, and is practically treated as a distinct class of wood.

For purposes of competition the American hickory is imported; this and lancewood being the only successful rivals of the English ash, the American ash, except in the young wood, scarcely winning a place.

AMERICAN COMPARED WITH ENGLISH ASH, ETC.

Having set up a standard of comparison for the English ash, we can apply the guage to the American species with a great amount of confidence.

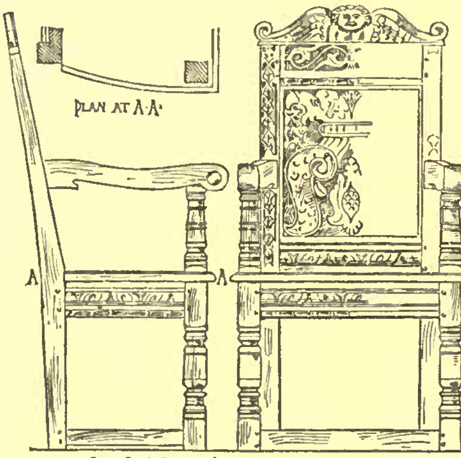
The specific gravity of the American ash is 588, against English 736; its elasticity is 773 against 1,289, it weight per cube foot 30 lbs. against 46 lbs. On scantlings as above, the American broke with 638 lbs., whilst it required 862 lbs. in the case of English wood. The deflection at the crisis of breaking was $7\frac{375}{1000}$ against $8\frac{625}{1000}$.

From the above it will be seen that the American wood is about one-fourth less in its specific gravity than the English, its elasticity being fully one-third less. The breaking weight of the American is fully one-fourth less than the English, but the deflection at the crisis of breaking is not so marked, whilst the weight per cubic foot is one-third less.

The wood is undoubtedly inferior to that of European growth, and if, as contended by Darwinian students, it is merely a variety of an original stock akin to that of European growth, the inferiority can only be traced to its acquiring in some degree the habits of an aquatic plant, by which the fibrous system has gradually declined in favor of an increase of cellular tissue until the change has become radical.

In America there are other species of ash; the "brown-barked," *F. pubescens*, which produces a reddish-colored wood; the "black-barked ash," or water ash, *F. sambucifolia*; the green ash, otherwise the Western black ash or walnut-leaved ash, *F. juglandifolia*; and the blue ash *F. quadrangulata*. The wood of these is more or less used for local purposes, but as they sparingly enter into commerce, when compared with the white ash, they merit nothing further at our hands than a passing notice.—*Timber Trades Journal.*

THE TOWERS OF SILENCE.



Old Oak Chair, Appledram Church, Sussex, Eng.

ON the northeast crest of Malabar Hill are situated the famous Towers of Silence. There are two approaches to the extensive tract of ground on which they are built. From the Gowalia Tank road towards the north a winding avenue of recent construction leads to the gateway at the top, on which is an inscription that none but Parsees may enter there. This prohibition was rendered necessary, it is said, by the unseemly and inconsiderate conduct of those who used formerly to be admitted within the enclosure. The gateway is also reached by a sort of giant staircase, half a mile long, which, starting from the Gaumdvi road, close to Back Bay, comes almost straight up the hill. Both approaches are strikingly picturesque.

The visitor who has obtained permission to disregard the notice at the entrance will find, on passing the portals, that he is in a kind of small court-yard, from which he can only advance by mounting some half-dozen steps. On the right is the Suggree, a low stone building, open on all sides, in which prayers are offered for the dead. The chief object of having the court-yard lower than the level on which the Suggree is built is to prevent the ceremonies from being profaned by the gaze of unbelieving eyes. When the mourners are numerous they group themselves around the building, and from its being open they can, of course, see all that goes on within, and take part in the prayers. The dead, it should be mentioned, are never taken within the Suggree. Between the Suggree and the garden is a large and handsome building, with arched roof, designed to supersede the present Suggree, which is found to be inconveniently small. Passing this new erection we enter a beautiful garden ablaze with flowers, amongst which roses are conspicuous. Along the walks are iron garden-seats of elegant structure and European make. Here the relatives of the dead rest after the toilsome ascent of the basalt staircase, and on subsequent occasions come to pray. Beyond the garden, on the undulating summit of the hill looking towards Malabar Point, is the park-like, grass-covered tract, in which, at irregular intervals, are the Towers of Silence, where the dead are laid. The Towers, of which there are six, are round, and, on an average, from thirty to forty feet high, and as much in diameter; one or two are, perhaps, higher. They are solidly built of stone, the walls being some three feet thick, and they are all colored white. There is no window, and only one door, covering a small aperture about a third of the way up. To this aperture access is obtained by a narrow stone causeway, up

which the dead and the bier-bearers alone may venture. So sacred are the towers that no one except the bearers who are set apart for the purpose may approach within thirty paces of them. Inside, on the rock pavement, spaces are marked out on which the dead are placed to await the vultures, and pathways are marked out for the bearers to walk upon without defiling the place where their unconscious burdens are to rest.

When a Parsee dies his soul goes to heaven, but his body must not be tainted by corruption. Therefore it is at once washed and purified, and if there be yet time it is at once carried to the towers before sundown. If death takes place, however, after, say, three o'clock, when there would not be time to gain the towers and pray becomingly before dark, the body is kept till the early morning. Having been rendered undefiled, it is clothed in white, and prayers are offered at the house by family and friends. None may henceforth touch it; it is pure and must so remain. The women of the family take a last look, and the light bier on which it has been placed being covered with a white shroud it is carried by the bearers to the hill. No vehicle can on any account be used; no one must even follow in a vehicle; the whole journey, no matter what the distance, must be made on foot. All who form part of the *cortege* must have been washed and purified and clothed in white, and to touch any one would be to become defiled. The women in some cases wear mourning — black — but the men never. No woman attends a funeral; the female relatives of the dead always remain at home on that day, but they may, and do, go afterwards to the garden near the towers to pray.

Carrying the body and following it in procession, holding scarfs passed from one side to the other, those forming the *cortege* wend their way slowly to the foot of the steps leading to the top of Malabar Hill. Laboriously ascending these, they reach the crest in a quarter of a hour, and the priests go through the sacred ceremonies in the Suggree. Some Parsees consider that the prayers thus rendered have the effect of averting all decomposition or other defilement; but this view is not universally entertained. When the prayers are over, and those who have come a long and weary journey are somewhat rested, the body is borne to the foot of the causeway leading to the door of one of the towers. Here the face is uncovered, so that all may take a last, lingering look; it is covered again, and the form disappears into the tower.

Were there not serious misconceptions to be removed we would not seek further to penetrate these mysteries; but, as stories in which there is more of horror than of fact are rife amongst those who know absolutely nothing of what really takes place, it is better that the truth should be fully told. The towers are scattered over a large and park-like enclosure, secluded by its elevation from every eye. Outside the lofty wall which encircles the whole space there are hundreds of acres of land, partially cultivated, which the Parsees claim, and which while in their possession they have carefully kept as a sort of neutral territory between the domain of outsiders' bungalows and that of the towers. What goes on inside, therefore, no one can see, and, of course, no one need be offended at. It is the imagination alone that is shocked, and it is more easily shocked from being quite uninformed of what really happens. What happens is this: some fifty vultures make their abode in the lofty palms within the enclosure, and when the dead is deposited in towers, they swoop down and do not rise again till all the flesh has disappeared. In a few hours none of the body remains except the bones. Those who retail stories about fragments of human bodies being taken up by the vultures and carried outside the park and the surrounding neutral belt, and then being dropped on the roads, are ignorant of the habits of these jackals of the air. On the American pampas, when they alight upon their quarry, they are so loth to quit the spot that they are eventually unable to fly from it on the approach of horsemen, who find no difficulty in knocking them over with their whips. Within the towers they are secluded from all disturbance, and those who have watched for the purpose have never seen them come to the top with any substance whatever. It is only when all is over that they come to the summit of the towers, where they remain for hours without moving. Then they take their heavy flight to the palms around; seldom, indeed, do they go beyond the trees in the rough ground outside the vast compound. There is nothing of a sacred character ascribed to these useful but obscene birds. They are regarded simply as a means of preventing decomposition, and in accomplishing that task they perfectly succeed. The consequence is, that the grounds about the Towers of Silence have nothing of the hideous taint of the charnel-house. There is nothing obnoxious to health; there is not the faintest odor of death to mingle with the perfume of the roses blooming around.—*The Times of India.*

COMMUNICATIONS

[*We cannot pay attention to the demands of correspondents who forget to give their names and addresses as guaranty of good faith.*]

MASTIC.

CHICAGO, ILL., June 26, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs,—I have had occasion to make some alterations and repairs in an old building, erected about thirteen years ago, the front of which is composed of what the owner says was called "French Mastic," and that marble-dust, litharge, boiled-oil and color were some or all of its ingredients. The recipe was taken from some book, but he does not remember what one.

I wish to patch up this old front in places, and would like to obtain the recipe for the "French Mastic," and any information that you can give me will be thankfully received.

You may answer through the columns of your weekly, or by letter, as you see fit. Yours respectfully, EDW. C. REMICK,

[WE presume the formula for French mastic was, fifty parts of marble dust to ten parts red lead, and enough boiled linseed-oil to moisten the mixture—just enough to make it work easily under the trowel. Before applying the mastic, the wall should be given three coats of boiled linseed-oil, giving time for each coat to dry thoroughly. It takes some months to acquire its ultimate degree of hardness, though it gets its first set in a very short time. A mastic facing is expensive to maintain in good condition, since the evaporation of the oil used in mixing makes it necessary to paint or oil it at intervals.—EDS. AMERICAN ARCHITECT.]

A QUESTION OF FOUNDATIONS.

HARTFORD, CONN.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs,—Which of these two foundations, in a heavy clay soil, is the better, other circumstances being equal?

1. Sandstone footing-course, 10″ thick, 3′ wide, and 5′ or 6′ long. Clay is moistened, then cement grouting applied, and the stones worked back and forth until a firm bed is obtained. A 2′ wall is built on this.

2. A trench is dug six inches lower than for footing stones, and sand dumped in and rammed down. On this, sandstones about 1′ 6″ x 2′ 6″, of irregular thicknesses, are laid, locking joints, the length of one stone, 2′ 6″, forming thickness of the wall. Cement grouting is poured in between the joints, and, after drying, the 2′ wall is laid, as in the other case, but locking more closely into the bottom course.

The former method has had my preference, but this one is strongly recommended as being less expensive and less likely to settle.

NARTHEX.

[So far as we can understand the situation, either method will give a good foundation, though we do not think that the larger sandstone footings, which our correspondent probably believes can be used to as much advantage as granite stones of the same dimensions, offer any better security against unequal settlement than the stones used in the second method. The idea of bedding the footing on a layer of sand is an excellent one when properly applied, but we question if a six-inch layer, which could all be easily absorbed by the underlying clay when saturated with moisture, will offer all the benefits which can be obtained by the use of sand in a foundation. *Engineering News* has within a couple of months published some interesting papers on the use of sand, which we commend to our correspondent's attention.—EDS. AMERICAN ARCHITECT.]

CAN A CORPORATION'S SALARIED SERVANT CLAIM THE PROTECTION OF "PROFESSIONAL USAGE"?

BALTIMORE, MD., June 3, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Can you direct me to any articles in your valuable paper, or any *practical* work on acoustics of public halls and theatres?

I also take the liberty of asking your opinion as to the right of possession of drawings executed as architect for a company or corporation, extending over a number of years and paid an annual salary, together with all office and travelling expenses in lieu of a commission. Does not the same rule or custom apply, or has the company any more right to demand or keep possession of *any* or all of the drawings upon termination of engagement than if the work had been done in the usual way on commission?

Yours respectfully, "OLD SUBSCRIBER."

[FOR what may be called a popular knowledge of acoustics, we recommend Dr. Lardner's "*Hand-book of Electricity, Magnetism and Acoustics:*" for the application of the principles of acoustics to buildings, we venture to suggest, though we have never seen the book, that Mr. T. Roger Smith's "*Rudimentary Treatise on Acoustics of Public Buildings,*" is probably as useful a work as any. These works can be obtained through any importing bookseller.

The second question can be answered more easily than those which are usually proposed concerning the vexed matter of the ownership of drawings—the importance of which, save in exceptional cases, we believe is generally overestimated by the profession. Our correspondent evidently entered the employ of the railroad like any other employé, and made no effort to inform the officials that he wished them to import with him all the usual professional customs, of which they were, of course, ignorant, and whose protection he can therefore hardly claim. Moreover, by accepting a salary in lieu of the usual recompense by percentage, he seems to have abandoned the rights and privileges of an independent professional — one of which is the debatable right to the drawings he makes — and to have become simply the company's salaried servant, and as such it unquestionably has the right to claim whatever he does in the special line of his work during the hours' work for which his salary is paid. In this case the "tools of service" argument cannot fairly be applied, for it must have been known to our correspondent, at the time he entered the company's service, that railroads have a way of duplicating their stations and other buildings, and that he was hired to make drawings quite as much as designs. Before a jury we think the company's lawyer would only have to suggest, to win his case, that our correspondent's claim under this plea was as reasonable as would be that of the head book-keeper who, at the expiration of his term of service, should seek to go off with the company's cash-book and journal, on the plea that they were "tools of service," maintaining that in leaving the ledger, which showed the results of the entries in the other books, he left all that the company could claim as its own.—EDS. AMERICAN ARCHITECT.]

THE EQUILIBRATION OF AN ARCH.

Bridgeport, Conn., May 26, 1886.

To the Editors of the American Architect:—

Dear Sirs,—Will you kindly give an opinion as to the stability of the arch shown by the enclosed sketch? One party claims that it is all right, and that the line of thrust lies sufficiently within the abutment, while another maintains that some sort of a tie will be required at the spring of arch. The arch carries no weight excepting its own and that of the roof above.

An early reply through the *American Architect* will be appreciated.

Subscriber.

Our correspondent has written a second letter, hoping to hasten our reply, so we will say that we have not found time to examine the matter, since it is a real problem, which requires time for its solution, which is propounded. If he will accept a snap judgment, we will say that the construction seems sufficiently safe, unless the belfry is actually to be used for bells: in that case we recommend him to be careful and discover the line and amount of his thrust; say by the method explained in the *American Architect* for July 2, 1881.—Eds. American Architect.]

NOTES AND CLIPPINGS

Westminster Abbey.—If Westminster Abbey were to tumble down some fine morning because, owing to disruption bills and other political preoccupations, the Government could find no time to permit the Dean and Chapter to get possession of some portion of their own property in order to spend the proceeds on repairing the edifice of which they are the freeholders, the result would probably be by many people deplored as unfortunate. This is, however, at present, a by no means impossible contingency. By one of the beautiful examples of compensation in which nature is so rich, it had been arranged that as soon as the London smoke became injurious to the soft Caen stone of the Abbey the Chapter estates in Tyburnia should be built over so as to provide the necessary funds for repair. But Parliament stepped in and destroyed the balance by handing over all the income, except that which was necessary for ordinary working expenses to the Ecclesiastical Commission. And now Parliament must be appealed to, to undo its own handwork. As the Chapter estates are far more than sufficient to defray all the expense that it is now proposed to incur, it is possible that the bill will be allowed to pass without any protest against the wickedness of religious establishments and the diversion of national funds to sectarian purposes; though the most fanatical of Liberationists might well pause before describing the "great temple of reconciliation," which in the last few years has received Darwin and Livingstone and Stanley within its walls, as the church of a sect.—*St. James' Gazette.*

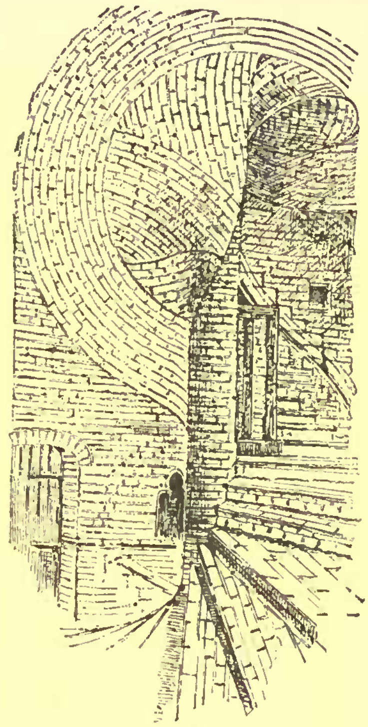
Painters and Sculptors.—The history of art is so rich in illustrations of precocity that it is difficult to select the best examples. Mantegna showed such marked ability as a child that he was taken up by a patron and entered by his master in the guild of painters before the completion of his eleventh year. Again, Andrea del Sarto is said to have shown fondness for drawing as a child, and at the early age of seven to have been introduced to the world of art in the shop of a goldsmith. Raphael seems to have been a painter from the cradle. He was sent to learn of Perugino when twelve years old, and at seventeen was painting on his own account. Tiziano showed as a child a decided preference for art over classics, and painted at the age of twelve a Madonna and Child in the tabernacle of a house, and about two years later studied under Gentile Bellini. Tintoretto used, as a child, to draw on the walls of his father's house, and received the name by which he is most widely known at this early date. Hardly less striking in his precocity is Michael Angelo, who as a lad kept running off to the studios, and at fourteen was received by Ghirlandajo as a regular pupil. Turning from Italy, we meet with no less interesting illustrations of artistic precocity. Murillo displayed talent as a child, covering the walls of his house with his drawings. It is said that he painted pictures as a boy and sold them at the fair. Holbein, who was taught at an early age by his father, painted finished pictures by the age of thirteen. Ruysdael is said to have painted notable pictures at twelve. At the same age Cornelius painted original compositions in the cathedral at Neuss which show great talent. Vernet helped when a boy to paint his father's pictures. Ary Scheffer, the son of a painter, painted from early childhood, and exhibited in the Amsterdam *Salon* at twelve. Among sculptors Canova is said to have carved a lion at twelve. Thorwaldsen entered on a regular course of study at eleven. Coming to our own country, we find instances of precocity which equal, if, indeed, they do not surpass, those furnished by other countries. Perhaps the most remarkable instance is George Morland. He is said to have taken to pencil and crayon almost as soon as he left the cradle. Sketches of his, made at four, five, and six, were exhibited to the Society of Artists, and won praise for the child artist. Sir Thomas Lawrence was another childish marvel. As a small boy he could draw portraits, and at nine not only copied historical paintings in a masterly style, but succeeded in compositions of his own. At ten his childish frame was such that he was sent by his father to Oxford to paint Bishops, Earls, and other notabilities—an experiment which brought great gain to his impecunious parent. At seventeen, the period of his riper and more lasting fame commenced. With these instances must be reckoned Landseer, who, taught by his father, could draw well at five, and excellently at eight. When only thirteen, he drew a majestic St. Bernard dog, which was etched by his brother, and in the same year pictures of his appeared in the Royal Academy under the name of Master E. Landseer. Gainsborough was a confirmed painter at twelve. Turner, though hampered by poverty, made such progress that he exhibited at fifteen. Wilkie says he could draw before he could read, and he exhibited at fourteen. Flaxman amused himself when a sickly child by drawing in crayons, and exhibited busts at fifteen.—*The Nineteenth Century.*

TRADE SURVEYS

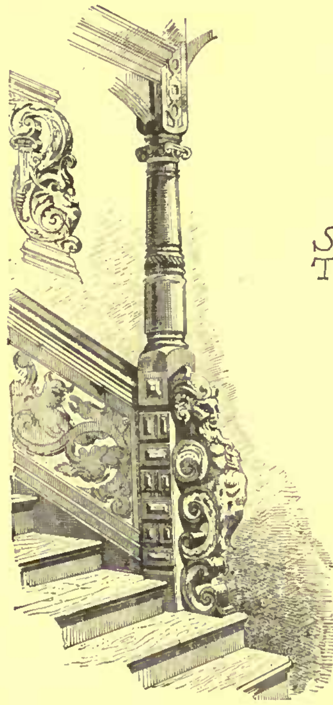
Commercial and financial statistics from such trade centres as Boston, New York, Philadelphia and Chicago, which have been gathered during the past few days, reassert the favorable opinions which have been heretofore expressed. The clearing-house exchanges exhibit a very gratifying increase. Bank statements show an increase in the available money for lending, and the reserves are also increasing. This does not mean that less money is wanted for general use, but that we are practically departing more and more from the credit system; that collections are prompt; that there are comparatively few losses, and that the country at large is making more than it is spending. This fact is proven, also, by the growth of building and loan associations, by a wonderful expansion of manufacturing capacity, and by a general increment of invested capital. In fact, there is a perceptible hardening of prices, and here and there a slight advance in quotations. Cotton is in very active demand at good prices; wool has advanced and is booming upward; raw and finished silk goods are in active demand; the clothing, hosiery and carpet interests are especially busy, and the wholesale houses even now report a better demand than they have been accustomed to at this season. Fortunately, these improvements do not mean that we are about tumbling headlong into a period of over-production. The great captains of the industries know too well from past experience where the danger line runs. The improvement, while it is a positive one, is of such a conservative character that no downward tendency in prices is likely to grow out of it. The present trade forces beneath the surface will not be changed this year. The necessities are such that the present firmness in prices will continue even under an enlarging production. Railroad building begins next week in several of the Western States on a scale of magnitude not witnessed since 1882. About 150,000 tons of rail are to be delivered as fast as they can be loaded and shipped. In stock circles the bull movement is strong. It is due partly to the fact that all the standard securities are in demand. The larger manipulators are holding back. The smaller investors are coming forward. Considerable money is coming from the interior. Railroad properties like the Northern Pacific and the East Tennessee, Norfolk and Western are increasing in value and in demand. A good many railroad properties which have been hanging on the verge of bankruptcy are once more getting on their feet. This reference to railway and stock movements is proper at this time because of the effect that increasing earnings have upon general trade and business. Building activity is general. In the New England States it is more apparent in the smaller towns than in the larger. Through the Connecticut valley a great deal of work is under way. In the Hudson valley a large amount of work has been undertaken within a month. Real estate is bringing good prices. Movements are not of very large proportions because of the conservative policy pursued by large operators. Land is being bought as wanted, therefore whatever advance is made is sound. The shrinkage going on in prices, instead of doing harm, is laying stronger and broader foundation. No trifling will be done with financial questions in Congress. In fact, the contemplated issue of one and two dollar bills, points to a slight increase in the volume of currency. It is the commonsense course. If money is needed and silver will not go, it is sensible to put it in a shape that it will go, viz., in paper. While there is no scarcity of money, the necessities for more money are constantly growing. The great bulk of business men are giving more attention to the expansion of their business than to the getting of large profits. Throughout Pennsylvania and Ohio a great deal of building will be done this month. Some of it is entirely new. The manufacturing towns are taking the lead. A good deal of mill capacity is being added. It has been said before that the country is making more iron than ever, and this fact means a great deal. The manufacturers of machinery will, as a rule, employ more labor in July than heretofore, and contracts for autumn and winter work will be earnestly solicited at the low prices, which were established during the spring, when shop managers became more anxious for business. In the farther West architects and builders send very good reports. Very little trouble is apprehended from unsettled labor. The decrees of the labor leaders are being respected. Very few strikes have taken place. Employers have more confidence and are entering upon larger undertakings. The announcements of new enterprises, while not so frequent as early in the season, are sufficient. The best authorities in textile matters predict the largest autumn dry goods trade ever had since 1880. An increase in business is reported, due to the free arrival of Eastern centres, of buyers from jobbing markets in the West and South. Taking a glance at the coarser industries, it is to be observed that there is an evident improvement, if not of business actually arriving, there is an improvement in inquiries and in the presentation of probable requirements for river and lake tonnage, for railway rolling stock and equipments, and for material for large building enterprises. In the Ohio Valley quite an impetus has been given to industrial operations. The iron workers have concluded to work twelve months more at last year's wages. The nailers have resumed work at the old price. The action of these two branches will not be lost upon other labor associations. In the lumber trade a very heavy distribution is in progress, and there is no difficulty in disposing of large arrivals of lumber. In the Northwest more or less cutting of prices is reported within the past few days. All mills are running and large quantities of lumber are finding their way to market. The coal trade is in a temporarily depressed condition. Trade combinations have not been able to keep up prices, which are below last year's price in Eastern markets especially. The spirit of competition has broken out among the miners in Western coal fields, and the programme of peace marked out last winter at Columbus is in danger of being completely broken up. A federation of employers was attempted at New York a short time ago in order to protect themselves against the arbitrary action of labor organizations, but it was concluded to do nothing more than to recommend the employers in each separate industry to combine for their mutual protection. No general federation will be attempted, and, in fact, is not desirable, even if practicable. In fact, when employers study this labor question a little closer they will discover that the perfect organization of labor does not involve any surrender of an employer's just rights. Congress will do nothing of a practical nature with the labor question because it cannot. A labor committee is soliciting some legislation bearing upon labor interests, which can be passed without detriment to capital or much benefit to labor. The question of arbitration will settle itself outside of Congress. The question of wages will remain where it belongs, a question of agreement between employers and employed. The only loss which employers will suffer, if it is a loss, will be their ability to independently fix the value of labor, or to discharge employés without a cause which organized labor will recognize. Competition will continue to be a vital and ruling factor, in the regulation of wages, but an advantage will follow, viz., the controlling of competition between employers themselves, and those who sell their products.



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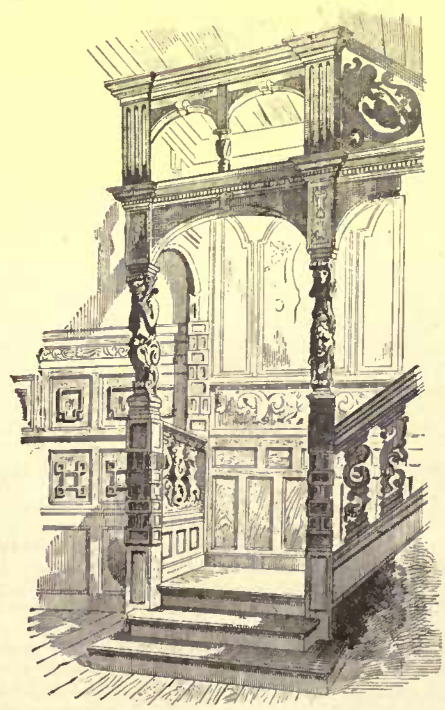


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STAIRCASES.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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CONTENTS

THE little local excitement that was stirred up by the legislative discussions over the bill to provide a new State-house for Massachusetts has blown over, and like a bad dream has vanished with the long-delayed departure of the law-makers to their several homes. It appears that, though the measure was seriously discussed in both houses and passed through most of the stages preliminary to a final enactment, it was defeated on the last day but one of the session by a satisfactory majority, as soon as it was made to appear that most of the members had voted for the measure under the mistaken belief that they were simply voting in favor of appropriating some eighteen thousand dollars for certain needed alterations and repairs of the old structure, against which public opinion would never think of raising its voice. Although the blunder raises certain suspicions as to the intelligence of the members of the General Court, who have just taken to their homes the much desired title of "Honorable" and an extra hundred dollars of salary, it is consolatory to find out that some members had sense enough to discover the misapprehension even at the eleventh hour.

SO far as we can judge, the competition for the Kansas City Exchange building has ended in a manner that justifies the unusual care which was taken by the committee and their expert adviser to secure a perfectly fair contest. We confess to having entertained a fear lest this, one of the first competitions that has been planned in accordance with the latest sentiment of the profession on the subject, might not receive at the hands of the leaders of the profession the respectful consideration it deserved, and the building committee, which from the first has exhibited a clearness of perception and a liberal-minded receptiveness very uncommon, find that it had spent its money for designs which were of no real service to it. Fifty-three designs were submitted, only two of which had to be thrown out for non-compliance with the stated conditions. Of the five designs finally selected by the professional adviser, Professor Ware, and by him submitted to the building-committee, the one designed by Messrs. Burnham & Root, of Chicago, was selected by them as best meeting their requirements. The other successful authors were then placed in the following order of merit: Messrs. Edbrooke & Burnham, of Chicago; Watson & Tuckerman, of New York; J. L. Faxon, of Boston; and W. W. Clay, of Chicago. It is curious to observe that the building-committee, having remembered, perhaps, that "good wine needs no bush," and so decided that it was not necessary that the designs of the special paid competitors should be distinguished by a private mark from the designs of the unpaid, is rewarded by discovering that though unaided by any brand or ear-mark it has selected for execution the design of one of these special competitors.

THE majesty of the law seems at length likely to receive a tardy recognition in the several cities which a few years ago passed ordinances that all electric-wires must be placed underground before certain dates, fixed at fairly remote periods. It has been a matter of curious interest to the lay mind to observe how easy it seemed to be for large monied corporations to fly in the face of both public opinion and municipal law, and the success of their negative efforts must amongst other things have greatly augmented the general respect entertained for an injunction. To us this seems the most powerful legal fiction yet invented, and there really seems to be few things that a really able-bodied injunction cannot accomplish— or prevent. If our memory serves us, Chicago was the first city that took really active steps to abate the overhead-wire nuisance, and, in 1881, passed an ordinance that all wires should be below the surface on or before May 1, 1883. Until this day arrived the telegraph companies did little but protest against the law and declare that the impossible was required of them: when the fated day did come they simply took out an injunction which forbade the city to interfere with their poles and wires. Fortunately the city electrician, Mr. Barrett, was a capable and wide-awake official who fought the telegraph and telephone companies—since he had no appropriation to pay for a legal contest in the courts—by preventing them from renewing their poles and wires, arresting their men, and subjecting them to persistent persecution and pressure. At the same time the city succeeded in forcing new companies who desired to secure franchises to run their wires underground. The practical success which attended the working of the new companies' underground systems, taken in connection with that of a short portion of the fire-alarm circuit, which for a length of a third of a mile has worked in iron-pipes underground since 1876, encouraged Mr. Barrett in his efforts, and helped to convince the older companies that it was unwise to struggle longer. So, little by little, one company and another has been putting its new wires underground, and bringing the main lines into cables preparatory to taking the same step. The actual condition shows that a real progress has been made, for it appears that the City has one-and-three-quarters miles of conduit enclosing sixty miles of wire, the Sectional Conduit Company eight miles of conduit enclosing one hundred and fifty miles of wire, the Western Union ten miles of conduit enclosing four hundred miles of wire, the Chicago Telephone Company three miles of conduit enclosing seven hundred miles of wire, the Postal and the Bankers' & Merchants' nineteen-and-a-half miles of conduit enclosing five hundred miles of wire, and the Baltimore & Ohio Company half-a-mile of conduit enclosing fifty miles of wire. There are, then, over eighteen hundred miles of wire underground in Chicago, and other cities can turn to her to learn how much retardation and loss of electricity is occasioned by the wires being placed below the surface, and also which of the several kinds of conduits in use is most practically successful.

NEW YORK'S experience has been in some ways similar, though there politics have, to a certain extent, joined hands with the electric companies to resist the law. Still, if it had not been for the ingenious way in which the general fear of cholera was invoked two years ago, to prevent the wholesale opening of the streets, which the enforcement of the law would have occasioned, we believe that the wires would have been put underground at the appointed time. An Electric-Subway Commission, composed of persons of questionable fitness for the task, has been more or less employed for many months in considering the merits of the many systems of underground conduits submitted to them by inventors, and listening to the suggestions and advice of the experts of the electric companies and of those employed as their own advisers. A more efficient head (who will probably receive more than his proper share of praise) having at length been appointed, this Commission has at last brought its labors to such a point that it ventures to make a report and formulate certain recommendations and resolutions. Premising that the great expense of building what may be called practicable and permanent subways — that is, tunnels in which men may work at ease — prevents the accomplishment of the ideal solution of the problem,

the Commission states that it has turned its attention to considering which of the more temporary methods was likely to be electrically successful and pecuniarily possible. It has at length determined in favor of the adoption of a conduit of bituminous concrete, which shall possess certain fixed qualities of composition, density, elasticity, impermeability, resistance to heat and cold, and so on. As for the manner in which these conduits shall be used, the Commission declares in favor of what it styles the "drawing-in" systems; that is, frequent man-holes are to be established on the line of the conduit, which will allow wires and cables to be introduced into the compartments of the conduit and drawn through to the next man-hole. It seems to us that these conclusions might have been reached long ago, and that a large portion of the wires should already be underground. One step taken by the Commission seems strange, even if not reprehensible, considering what opportunities for jobbery it seems to offer. Finding that it had no money at command to begin the practical execution of its own recommendations, and acting under the advice of the Attorney-General of the State, the Commission has resolved to call into being a construction company, with which it may contract to make, lay and operate subways in conformity with the requirements now made public. New York, therefore bids fair to follow in the path already successfully travelled by Chicago, Washington, Philadelphia, Boston and Detroit, which all have more or less considerable lengths of underground wire in operation. It will be long before the companies, particularly the telephone companies, find the new method as convenient as the old; but as they are already discovering that municipal and State authorities, backed by the courts of law, are disposed to curtail their privileges wherever possible, they seem at length to perceive that there is worldly wisdom in keeping themselves and their operations as much out of sight as possible, if only for the sake of avoiding more severe harrying.

HERE in the East, the owner of a lot of land, who also supposed himself to possess the title to the building or buildings that might be upon it, would consider it extremely absurd were he to wake up some fine morning and find that the building or buildings had been transferred to some other lot, or were on their way to another location. In San Francisco, as we learn from the *Call*, this condition of things is so common as to excite very little attention and even less surprise. In fact, there is an activity in San Francisco real estate that is quite apart from the ordinary "activity," and that causes a phenomenal amount of building movings — more than double those in any other city of the same size, so it is said. Real estate titles are very apt to prove defective in San Francisco, and many men have built houses on lots that turned out to belong to some one else. In a case of this kind, as the real owner of the land could of course lay claim to the building, the only resource for the builder was to sneak the house away, unobserved by the land-owner, if possible, lest he secure an injunction and stop the transit. As injunction papers may not be served on Sunday, a favorite time for beginning this "house-stealing" has been midnight on Saturday, and it is told that not long ago six houses were taken into the street on one Sunday.

IT is a little difficult to determine from the newspaper reports, in which a girder, rafter and joist are spoken of as if synonymous or identical terms, just what caused the collapse of a portion of the Second Street Court-House, in Kansas City, on June 27, and it really does not much matter. So far as we can determine, the building in its best days was a good specimen of jerry construction; it had long been practically condemned by public opinion, and it had been partially wrecked by the wind storm of May 11, in a way which justified those who held it in evil repute; and it was while the damage inflicted at that time was being repaired that a partial collapse of the structure took place, which fortunately did no damage to the wretched prisoners confined in the jail attached to the building. It seems as if a commutation of sentence ought to be accorded to these unfortunate outcasts in compensation for their having been subjected to an unauthorized punishment,— an hour of peril and terror, as truly inflicted upon them by the judges as by an incompetent builder or architect. The point worthy of note is that competent expert advice is to some minds so unpalatable that it cannot be digested if it runs counter to the opinions or desires of those who seek it. The county judges, at first doubting their own architectural attainments, appointed a committee of three, among them the president of the local society of architects and the late superintendent of Buildings, to report on the advisability of repairing the damage caused by the wind. This committee advised that it was unwise to repair the structure, and seemingly recommended that it should be pulled down. The county judges then accomplished a notable feat: they acquired an instantaneous and competent knowledge of architecture, told the experts that their conclusions were erroneous, and discharged them, refusing, it is said, to pay for their services. The judges having thus at once asserted their own opinion, proclaimed themselves past-masters of building construction, and given a hint as to how they would treat those who did not reach the same conclusion as themselves, appointed a second commission to examine the structure, and on receiving its report that it would be well to repair the court-house, graciously accepted it, paid the members twenty-five dollars, and appointed one of them to be architect in charge. Shortly after, a portion of the building fell down. If lives had been lost, we presume this exceedingly able court would have conducted the inquest, called itself as expert witnesses, bullied all who wished to give testimony against it, interpreted statutes as it pleased, and acquitted itself of all blame in the matter.

LIVING on the skirts of a wood of no inconsiderable size, we have some personal knowledge of the difficulties that attend the preservation of forests. It is no unusual thing for us in springtime or autumn to have to drop the pen and go out and help such neighbors as think it worth while to "fight fire" — usually incipient ones. As for preventing the stealing of wood, the girdling of trees, and the wanton destruction that the tramp or native "hoodlum" delights in, it is absolutely impossible, unless stringent forestry laws can be enforced by a large and properly-organized body of foresters, such as are employed in European countries; for instance, Saxony, which has about as many acres of woodland as the State of New York, has a body of six hundred foresters to protect it. New York, on the other hand, which last autumn appointed a Forestry Commission, only authorizes the employment by it of sixteen foresters, who would be of as much practical use as so many children in preventing the destruction of the State's forests, which are scattered through two hundred and thirty-two townships lying in fourteen different counties. All that a force of this size could possibly do would be to discover and possibly prevent the unauthorized destruction of woodlands by railroads, such as has been effected by the Northern Adirondack Railroad Company, or such impudent assaults of timber thieves as were made on the United States timber lands in Florida and Louisiana. The New York Commissioners have found an ingenious way out of the difficulty which the letter of the law imposed on them and have appointed a "fire warden" in each of the two hundred and thirty-two townships, so that there are now employed in guarding the forests about half the number of men that older countries have found necessary. Besides this, the Commissioners have printed and posted in hotels and other public places four rules, which not only are of rather the goody-goody order, but, as there are no penalties for their infraction, are likely to have small effect on the lawless. One of them is, however, sensible and fairly practical: it provides that any one who wishes "to clear land by fire or turn a fallow" shall give the nearest fire warden five days notice, and his adjoining neighbors forty-eight hours warning of his intention, and must have competent persons on guard during the burning; and no such fire shall be allowed save when the trees are in full foliage. We find in the fire-tables of the *Chronicle* that there were reported forty-six forest and prairie fires in the United States during 1885, which consumed $1,776,375 worth of standing timber, from which it appears that a single careless hunter or tramp may cause an average loss of some $38,000 worth of standing timber, which in the form of dressed lumber would house a small town; and it appears a reasonable corollary to assume that if any of the new fire-wardens checks or prevents a single fire in heavy woodland his sole act will have saved to the State three thousand dollars more than the total appropriation the commissioners now have at their command. Another important step taken by the new officials is the preparation of complete maps, on a large scale, of all the State lands, copies of which are to be furnished to the new foresters and fire-wardens.

ANCIENT AND MODERN LIGHT-HOUSES.—I.



Latin Light-house, after a Medal in the collection of the Marshal d' Estres.

THOUGH there is incontestable evidence that light-houses did exist in ancient times, the old authors make but meagre reference to them, and of the towers themselves but seanty ruins remain; this is but natural, as they must of necessity have been situated in places not only exposed to wind and storm, but also frequently have formed portion of fortified places, and so subject to all the risks of war. Besides, a tower from its very shape is the least stable of architectural structures, and succumbs to accidents which other buildings successfully resist.

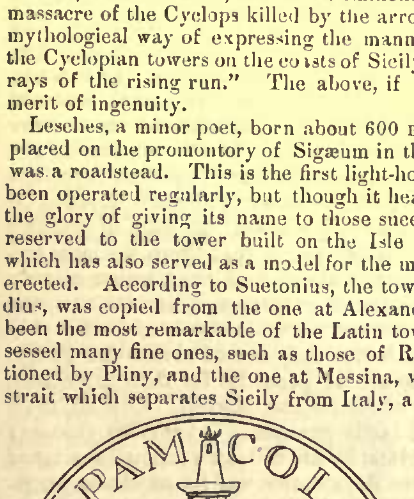
When Hercules put on the shirt of Nessus, he in his agony tore the flesh from his body, and finally unable longer to endure the torture, built and lighted a funeral pyre and threw himself upon it; when the flames commenced to lick his body a cloud descended from the sky, and carried him to Olympus. This legend may perhaps be the reason why the Greeks attribute the first light-houses to him. At Thasos, Smyrna and in Italy he was σωτηρ (Saviour), *i. e.*, protector of voyagers, and tithes were vowed to him to be spent in entertainment.

The oldest light-houses known were the towers built by the Sybians and by the Cuschites, who dwelt in lower Egypt; in addition to being light-houses they were temples named after some deity; they were held in great veneration by sailors, who enriched them with their offerings; it is supposed that they contained charts showing the coasts and the navigation of the Nile. At first these charts were engraved on the walls; later they were made on papyrus. The priests, who were the light-keepers, taught the pilotage of vessels, hydrography, and how to steer by the use of constellations.

The manner of lighting these towers was very primitive: the fuel was placed in a kind of iron or bronze basket composed of three or four dolphins or other marine animal interlaced together; then the basket was attached to a long pole projecting from the tower towards the sea.

The Baron de Zach says, "that the Sybians called these towers *tar* or *tor*, which signifies height; *Is* means fire, hence Tor Is tower of fire; from this comes the Greek τυῤῥις and the Latin *turris;* when these signals were situated outside of the villages on rounded eminences they were called *Tith.* Tithon, so celebrated for his longevity, seems to have only been one of these structures dedicated to the sun, and Thetis, former goddess of the ocean, only a light-house near the sea, called *Thit-Is*, fire on an eminence. And the legend of the massacre of the Cyclops killed by the arrows of Apollo is simply the mythological way of expressing the manner in which the signals of the Cyclopian towers on the coasts of Sicily were extinguished by the rays of the rising run." The above, if not true, has certainly the merit of ingenuity.

Lesches, a minor poet, born about 600 B. C., mentions a light-house placed on the promontory of Sigæum in the Troad, near which there was a roadstead. This is the first light-house which appears to have been operated regularly, but though it heads the list, it has not had the glory of giving its name to those succeeding it; this honor was reserved to the tower built on the Isle of Pharos, at Alexandria, which has also served as a model for the most celebrated towers since erected. According to Suetonius, the tower at Ostia, built by Claudius, was copied from the one at Alexandria, and appears to have been the most remarkable of the Latin towers. Italy, however, possessed many fine ones, such as those of Ravenna and Pozzuoli mentioned by Pliny, and the one at Messina, which gave its name to the strait which separates Sicily from Italy, and where the famous rocks of Scylla and Charybdis are found; and finally the light-house on the Island of Capri, which was overthrown by an earthquake a few days before the death of Tiberius.



Latin Light-house, after a Medal found at Apamea.

The shape of these Latin towers is somewhat doubtful. Herodianus says that the catafalques of the emperors resembled light-houses; now the catafalques were square, while the light-houses were not always so. A medal in the collection of the Marshal d'Estres shows a light-house of four stories, circular in plan; another medal found at Apamea, in Bithynia, an ancient country of Asia Minor, also shows the circular form, and finally, the light-house at Boulogne was octagonal.

THE LIGHT-HOUSE OF ALEXANDRIA.[1]

There are several noted ancient light-houses, of whose history and appearance we have more or less authentic accounts. Prominent among all is the famous one at Alexandria, on the Island of Pharos, which was regarded as one of the wonders of the world. Opinions differ as to whom to ascribe the honor of building this magnificent structure; by some it has been assigned to Alexander the Great, by others to Cleopatra; but the best evidence is that it was erected by Ptolemy II, Philadelphus, who reigned 283-247 B. C. It is quite certain that Sostratos was the name of the architect. The following rather tricky story is told of him: like many another architect he desired to perpetuate his fame by inscribing his name on the work, a perfectly laudable ambition; to accomplish this he engraved deeply on one of the stones, "Sostratos of Gnidos, son of Dixiphanus, to the Gods protecting those upon the sea." Knowing very well that Ptolemy would not be satisfied with this inscription, he covered it with a thin slab of stone, or coating of cement, which could not long resist the action of the weather, and on this he inscribed Ptolemy's name: as he anticipated, the covering disappeared in some years, and with it the name of the king, thus keeping all the credit to himself. Pliny says that Ptolemy purposely left off his own name so that Sostratos could have all the glory, but this is so directly contrary to the way in which princes ordinarily act, both in ancient and modern history, that such an excess of modesty is hardly probable.

Another disputed point is whether the tower gave the name to the island or the island to the tower; the latter is the more likely; at all events this light-house has given *its* name to its successors, and has become the generic name.

Light-house in Latin is *pharus;* in Spanish and Italian, *faros;* in French, *phare;* and even in English *pharo* was once used, though now obsolete.

The tower was square in plan, of great height, and built in offsets. Edrisi, an Arabian geographer of the thirteenth century, said that in his time it was six hundred feet high, and that the light could be seen one hundred miles; no true American will believe this, for have we not the Washington Monument, five hundred and fifty feet high, the "tallest artificial structure ever erected on the surface of the earth?" it is more consoling to our vanity to consider that the old Arabian was romancing.

At the top of the tower was the brazier to contain the fuel; it was truly a "pillar of fire by night, of smoke by day," and must have been a welcome sight to the storm-tossed mariner, though the labor of carrying the fuel to the top of that tall tower must have been a wearisome task to the poor light-keepers.

The tower, from all descriptions left us, seems to have been built in a manner similar to the Tower of Babel, which had eight stories, or as Herodotus calls them, towers placed one upon the other. Pliny affirms that its cost amounted to eight hundred talents, or about $946,000.

But to go back to our Egyptian who evidently was an ardent admirer of this structure: "This light-house," says he, "has not its equal in the world for excellence of construction and for strength, for not only is it constructed of a fine quality of stone, called 'kedan,' but the various blocks are so strongly cemented together with melted lead, that the whole is imperishable, although the waves of the sea continually break against its northern face; a staircase of the ordinary width, constructed in the interior, extends as high as the middle of the structure, where there is a gallery; under the staircase are the keeper's apartments; above the gallery the tower becomes smaller and smaller until it can be embraced by the arms of a man. From this same gallery there is a staircase much narrower than the tower, reaching to the summit; it is pierced with many windows to give light within and to show those who ascend where to place their feet. At a distance the light appeared so much like a star near the horizon, that sailors were frequently deceived by it. Arabs and travellers have told wonderful stories about this tower; some say that Sostratos supported this immense mass on four great stone crabs, and even more remarkable, that Alexander the Great placed on the top of the tower a mirror constructed with so much art that by means of it he could see the fleets of his enemies at one hundred leagues distance, and to enter still more into particulars, that a Greek named Sodorus, after the death of Alexander, broke the mirror, while the garrison of the tower was asleep."

DOVER TOWER.

There are two towers, one at Dover, the other at Boulogne, which for many years lighted the British Channel. But little is known of the history of the former; some believe it to be the same tower that now stands in the middle of Dover Castle; others think that a grand mound of masonry, stones and chalk, near Dover, called the "Devil's Drop," are the ruins of the ancient tower. It was built by the Romans, and was probably octagonal in plan, and resembled in other particulars its mate at Boulogne.

Its antiquity no doubt exceeds that of any light-house in Great Britain. It has not been used as such since the Conquest, but before then burned for many centuries those great fires of coal and wood formerly maintained on several towers still standing on those coasts.

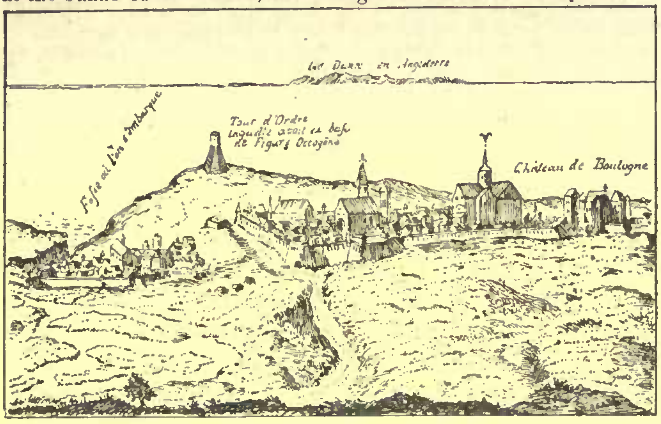
LA TOUR D'ORDRE.

Of the tower at Boulogne we have more accurate information. It

[1] During the illness of the editor the illustrations of the light-house at Alexandria, intended to accompany this article, were published by mistake. See our issue for May 15, 1886.

is well known under the name of the *Tour d'Ordre* or *d'Orde.* Two centuries ago its ruins might still be seen.

The story goes that when the too famous emperor Caligula arrived at the banks of the Rhine, and thought to invade Brittany, chance



Tour d'Ordre, Bologne, after a drawing by Claude Chatillon.

obtained for him the voluntary surrender of a young Breton prince. To celebrate this piece of unforeseen good luck, he caused to be erected on the cliffs of Gioriacum, now Boulogne, a triumphal monument to perpetuate his renown. The exact date at which this monument was changed to the more useful purpose of a light-house is unknown; but it is certain that a light shone from its summit in 191 A. D., as there is a bronze medal upon which Commodus bears the title of Brittanicus, in remembrance of the victory of one of his lieutenants over the Brittons, and which represents this light-house and the departure of a Roman fleet.

Located at the most convenient place for crossing the British Channel, the tower of Boulogne was kept in careful repair during the occupancy of Gaul by the Romans. It not only served as a light-house, but also as a fortress, and, owing to its position and massive construction, it was well suited for this purpose. In the sixteenth century, during the short and disastrous occupation of Boulogne by the English, the Tour d'Ordre, as it was then called, was surrounded by two ramparts, one of brick and the other of earth, and was armed with pieces of artillery. It was admirably located, either for the defense or the attack of Boulogne, for it commanded the city and both banks of the river.

However, it was not the hazard of war which made this tower lower its haughty front and caused its ruin. All that it suffered was the damage to its lantern, several times repaired. Its final destruction was entirely due to the carelessness of the mayor and aldermen, who took no pains to check the action of the sea at its base, and of subterranean springs which gradually sapped its foundation, so that finally, between 1640 and 1645, tower, fort, and even the cliff itself fell. The Boulognese were rather glad of it, for they had to pay taxes on the land, in virtue of an ancient right to a certain Lord de Bainethun. They argued that as the land had disappeared they were freed from further obligation to the proprietor. However, Parliament did not take that view of it, but informed Messieurs the Boulognese that as they were responsible for the loss of the tower, they could continue paying a tax of two thousand herrings, delivered at Amiens, Arras, or at other cities at equal distances that the proprietor might designate; or they could replace the tower in its former condition, and relinquish to the Lord of Bainethun, Baron of Ordre, the right of taxing all fishermen entering Havre. They concluded to pay the tax, and continued to do so until the French Revolution.

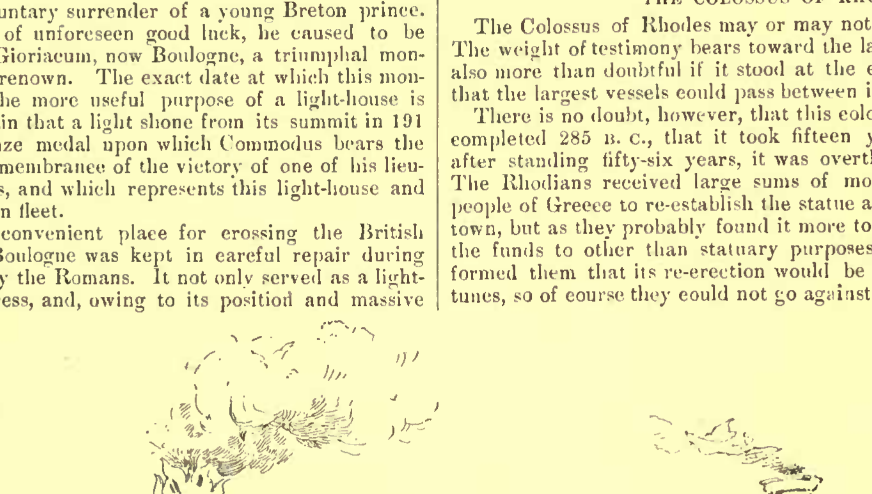
The accompanying design, after Claude Châtillon, engineer of King Henry IV, is apparently trustworthy. Descriptions of the tower are rather meagre; they give, however, some useful information concerning the situation, dimensions and form of the edifice, and also of the materials employed in its construction. The latter were yellow and gray stone and red bricks. The tower was situated the length of a cross-bow shot from the edge of the cliff; it was octagonal in plan, and one hundred and ninety-two feet in circumference. Like most Roman light-houses, each of its twelve stories was three feet less in diameter than the one immediately beneath it, thus giving the tower a pyramidal shape. It is stated that its height equalled its circumference, or, in round numbers, two hundred feet, which seems to be an unnecessary height for a tower situated on a cliff one hundred feet above the sea level. Each story had an opening in the middle like a door, and there could still be seen, in the beginning of the seventeenth century, three vaulted rooms, one above the other, connected by a stairway, and doubtless intended as dwellings for the keepers. The place where the fire was lighted is conjectural, as the chroniclers of the ninth century state that the summit was repaired so that fires might be lighted on it. It is reasonable to believe that before this repair the fire shone in a room in the upper story.

This ancient light-house is now replaced by modern lights, one a fixed red, visible for four miles, and two fixed white lights, visible at a distance of nine miles, erected by the French Light-House Board in 1835.

THE COLOSSUS OF RHODES.

The Colossus of Rhodes may or may not have been a light-house. The weight of testimony bears toward the latter supposition, and it is also more than doubtful if it stood at the entrance of the port, and that the largest vessels could pass between its legs.

There is no doubt, however, that this colossal statue of Apollo was completed 285 B. C., that it took fifteen years to build, and that, after standing fifty-six years, it was overthrown by an earthquake. The Rhodians received large sums of money from the kings and people of Greece to re-establish the statue and to rebuild their ruined town, but as they probably found it more to their advantage to apply the funds to other than statuary purposes, a convenient oracle informed them that its re-erection would be followed by dire misfortunes, so of course they could not go against the will of the gods.



Two Restorations of the Colossus of Rhodes.

Chares of Lindus, a pupil of Lysippus was the designer. It is said that he killed himself in despair, because, after he had spent all the money appropriated, the statue was but half finished, and that it was completed by another Lydian named Lachus. Such stories are rather doubtful.

The statue was about one hundred and eight feet high, and was made of bronze. After it was overthrown "it was still a marvel," says Pliny. "Few men could put their arms around the thumb; its fingers are larger than many statues. Its disjointed limbs seem vast caverns in which one sees enormous stones by means of which it was weighted. It is said that it cost 500 talents ($590,000), the sum which the Rhodians had taken from the equipages of war abandoned before their city by Demetrius when he raised the siege, fatigued by its length."

The ruins of the Colossus remained for nine hundred years, but in 672 A. D., Mauviah, one of Othman's lieutenants, had it broken to pieces, and sold it to a Jew, who carried it off on a thousand camels, if we can believe the Byzantine chroniclers.

The cuts show what it may have been. The treatment with the rays about the head and the flaming brazier in the hand bears some resemblance to our statue of Liberty enlightening the World.

Cost of our Wars — Register Rosecrans has written a letter to Congressman Warner in reply to a question from that gentleman, asking the expense to the government of our three principal wars. General Rosecrans replies that the sum assumed and paid by the government for the War of the Revolution was $6,000,000; the War of 1812 cost $115,000,000; the Mexican War, $135,000,000 and the War of the Rebellion $6,189,920,905.

AN EDITOR'S TRIP ABROAD.[1] — III.

ROWSLEY.— HADDON HALL.— THE LONDON EMBANKMENTS.

PARIS, June 19, 1886.



Stone Lion at Oum-el Awamid. From Renan.

ONE day in Liverpool is as much as most American travellers wish to allow themselves, and we had our trunks carried over the next morning by the hotel porter to the central station close by, and consigned to the guard for transmission to the "Left Luggage" room at St. Pancras station in London, reserving, to carry in our hands, baggage enough to enable us to stop over comfortably a night at Rowsley.

Rowsley, which is to the Midland Railway very much what Chester is to the Northwestern, lies at the confluence of the Wye and Derwent rivers, in the heart of the hill-country of Derbyshire, and derives its main interest from being the nearest station both to Chatsworth, which lies six miles north of the railway, and Haddon Hall, which is two miles south. Independent of these advantages, however, the village of Rowsley is brimful of that delicious charm which is to be found nowhere except in an English hamlet. The country lies on a limestone formation, and the houses, fences, barns, and even the shelters for the cattle in the pastures are built, in consequence, of stone, used with picturesque freedom and ingenuity. So far as I could see, there was hardly a brick in the place, even the chimneys being all of stone. The limestone is of excellent quality, hard and white, and if the chimney-tops are occasionally rebuilt as they burn out, the houses seem disposed to last for ages. The Peacock Inn, the only hotel in Rowsley village, although there are others in hamlets near by, was, as an inscription over the door relates, built by

IOHN STE
VENSON, 1652

but except that the stone floor of the entrance hall is a good deal worn, it seems in as good condition as ever. Very few changes have been made in the structure during the two hundred and thirty-four years which have elapsed since it was built. Most of the windows have mullions and transoms of stone, which show inside the room just as they do outside, and the frames, apparently of rough wrought-iron, for the leaded sashes seem to fit into grooves in the stonework, and to have been built into it, although so much mortar and whitewash was daubed over them that I could not tell to a certainty about this point. All the sashes above the transoms I found to be fixed in place, as were also those below the transoms, except one or two in each window, which had an inner iron sash hung to the frame, and arranged to swing out, with an elbow-jointed rod to keep them und r control, and a sort of latch fastening. The leads were, I should say, something more than three-eighths of an inch wide, giving the windows a substantial appearance quite different from the quarry glazing which we see in most of our church-work; the whole affair was extremely picturesque, and would have been in every way admirable, except that we did not dare to leave the window open through the night for fear that rain might come in. In other respects the interior of the house was very similar to that of one of our colonial houses. The front door was made of boards, with vertical battens, riveted or bolted through, about one in every three inches, but the other doors were panelled and moulded just like ours, with panel-mouldings apparently planted on, just as ours would be. The hostelry itself derives a certain interest from the connection which it appears to have with Haddon Hall, much of which is very little older, although it seems like a ruin in comparison with the inn. According to the legend of the Hall, Dorothy Vernon, the heiress of the family which had owned Haddon ever since the Conqueror gave the land to her Norman ancestor, eloped while a ball was going on in the great gallery, which we all know so well from the pictures, with Sir John Manners, who waited for her outside a door which still opens from the ante-chamber of the ball-room into the garden. Sixteen years after the elopement the accession of the Manners family to the estate was signalized by the erection of the Peacock Inn in the nearest village, displaying the crest of the new owners, whose heirs, the Dukes of Rutland, hold the Haddon Estate to this day. The proprietors of the Peacock Inn seem to take a modest pride in its antiquity, and keep up something of the old ways. Even in June a fire was blazing in the wide fireplace of the dining-room, and our bill, which seemed to be printed from a form composed during the Elizabethan period, provided a blank space for the charge of "rush lights," if we had happened to want any.

The general appearance of Haddon Hall, with its balustraded terrace and the row of deep bay-windows in the long gallery, is very familiar to most of us. Inside, the most curious of the less-known portions are, perhaps, the chapel, which still contains a great deal of Norman work, very well preserved, and must be the oldest part of the building, and the kitchen, which can hardly be much later, although it still retains its fireplaces and furniture. More interesting, however, in some respects even than the Hall, is the house which stands at the entrance to the grounds, and serves as a habitation for the custodian of the mansion. At some period this must, apparently, have been a sort cf store-room, or, perhaps, guard-house, but seems to have been made over later into a separate dwelling, for there is now attached to it a most curious little garden, full of old trees cut into the fantastic shapes which were fashionable two hundred and fifty years ago, but still bright with flowers, and as nicely kept as when Dorothy Vernon and her husband overlooked it from their front door. Ancient as the garden seems, the house to which it belongs seems far more ancient still. The plan is simple. A recessed porch, with an elliptical arch to carry the wall over it, opens on each side into a room, now as prettily furnished as other English cottage rooms, but covered with a flooring laid on huge beams, which project through the wall, while sloping buttresses, of considerable projection, stiffen the wall between the windows. The upper story, or, rather, half-story, as it is little more than a garret, seems to have been intended from the beginning for a dove-house, the whole gable wall, above the level of the tie-beams, being laid alternately with oak beams, and roughly-squared stones, set a few inches apart, so as to allow the pigeons to fly in and out. Viollet-le-Duc tells us that the possession of a "*colombier*" was in France in old times a mark of nobility, and the Vernons perhaps provided in this simple way for a flock of doves in emulation of some of their Normon relatives across the Channel. If so, their successors have to thank them for an idea which completes the picturesqueness of one of the most charming bits of domestic architecture in England.

We left the peaceful lanes of Rowsley with sincere regret, and were soon hurried out of the Derbyshire valleys into the smoke and grime which occupy most of the central part of England, and culminate in London. Here we were on familiar ground, and except that some of the buildings which were new and bright when I first saw them had taken on their London garb of dirt, there was not much change to note in the region about Piccadilly Circus, which Americans most haunt. We took advantage, however, of the opportunity afforded by our visit to the Tower, a comparatively small portion of which is now open to the public, to return on a river steamboat, sailing from London Bridge to the Chelsea Pier, past the whole length of the three Embankments, which are now being rapidly occupied by buildings of remarkable interest and beauty. It is hardly necessary to say that no site in London is so favorable for a building intended to be seen and admired as one of the Embankments, and the architects of the city seem to have understood this at once, and to have done their best to impress the proper character upon the work from the outset. Of course, the more important buildings, such as the new Royal Hotel, and some still larger and richer, which I did not recognize, are on the lower portion of the Embankment, below Somerset House, but the Chelsea end is adorned by rows of new dwelling-houses, nearly all of which are of great interest. Among them, as the steamer sails slowly past, one easily recognizes Norman Shaw's "Swan House," together with his unnamed house adjoining, and two or three more by the same hand, drawings of which have appeared from time to time in the English journals, while there are many others which show the familiar character of the work of other noted designers. I am sorry to say that Queen Anne architecture, as such, does not appeal very strongly to my soul, and Swan House, with its lanky windows and flat, expressionless façade, disappointed me. A good deal of Norman Shaw's work is in execution far less interesting than in his drawings, but there are many exceptions, and some of his smaller houses near by were made beautiful by a masterly use of recessed balconies and over-hanging stories, which other architects, in neighboring buildings, had also employed in different, but interesting ways. The general effect of the houses on the Chelsea Embankment, as seen from the river, is, however, to my mind, a trifle artificial. The rows of high gables, and the small panes of glass, seem a little too conscious of their resemblance to old Dutch work, and one misses the frankness of expression which characterizes the country houses built by the same architects. It is curious to notice the difference in style between the architecture of Chelsea, the stronghold of æstheticism, and that which prevails in the other new quarters of South Kensington and Brompton. While the Chelsea Embankment might be set down in Holland without exciting much remark, the Cromwell and Brompton roads would answer very well for New York. It is true that the London houses are apt to have more land attached to them than those in New York, and the London whitebrick is as yet imperfectly naturalized in America, but there is a good deal of it there even now, and the Avenue St. Nicholas, or any of the wide Harlem streets, might be built up from the South Kensington patterns without materially interrupting the course of the vernacular style — except in the way of improving it.

[1] Continued from page 3, No. 549.

The Illustrations.

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

THE TERRACE IN CENTRAL PARK, NEW YORK, N. Y. DESIGNED BY THE LATE J. W. MOULD, ARCHITECT.

[Gelatine Print, issued only with the Imperial Edition.]

MOUNT ST. MICHEL, BRITTANY, FRANCE.[1]

MOUNT ST. MICHEL, SKETCHED FROM THE DIKE BY MR. WALTER COPE, ARCHITECT, PHILADELPHIA, PA.

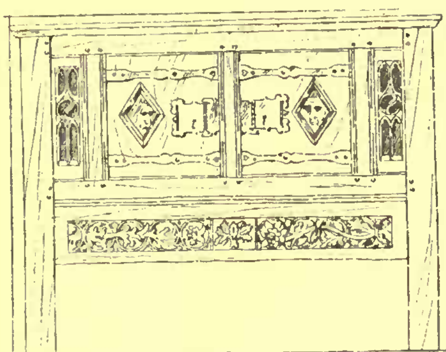
For a description of this renowned structure see our issue for March 11, 1882.

MONUMENTS FROM THE CEMETERIES ABOUT BOSTON, MASS.

FIREPLACE IN THE CHATEAU, AZAY-LE-RIDEAU, FRANCE.

THE ARCH OF CONSTANTINE, ROME.

LIGHT AND WATER-COLORS.



Flemish Credence, Oak. South Kensington Museum. After Sketch by John [illegible] Carter.

WHERE has been an animated correspondence in the *Times* on the action of light on water-colors, incidentally raised by a communication of mine not intended to provoke controversy. I imagined, indeed, that the fading of water-color pictures and drawings was so obvious and notorious as to be beyond dispute, and my intention was to suggest the best means of counteracting the evil.

I was, however, greatly mistaken. I found, indeed, to my infinite surprise, that darkness reigned where the fullest enlightenment might have been looked for, and where, literally speaking, darkness was a palliative, light was indirectly recommended.

The unqualified assertion, utterly erroneous as it is, that water-color drawings not only do not fade, but that they actually deepen in tone by age, was advanced by the highest authorities and masters of the art in question. . . .

Artists' pigments, whether they are embodied as "water" or "oil" color or in any other vehicles (generally speaking the substances employed are the same), are of the most varied and diverse nature and origin—mineral, vegetable and animal. Natural metallic oxides and earths, complex chemical compounds, gums, extracts, and the inspissated sap of trees and plants, juices and secretions from insects and the higher animals, are alike pressed into the service of the painter. Modern science and commercial enterprise have in our own time vastly augmented the number and variety of these coloring substances. Unquestionably thereby the artist's palette has been greatly enriched and the physical means of art extended; but whether at the same time those means have been strengthened and improved in the sense of durability is another question.

Painters in the old times, when their pigments were comparatively few and simple in their nature, were usually in the habit of preparing, purifying, and refining their own colors. They were alive and attentive to the physical properties of the substances they employed, discarding, as far as they were able, such as were notoriously fugacious in their nature or uncertain in their action upon other colors. Now, on the other hand, artists, as a rule, simply ignore all this, accepting with blind faith whatever the color-merchant offers them; ever craving for some newer and more vivid tint, be it as fixed and eternal as the sapphire's blue or the ruby's red or as short-lived and fleeting as a dream.

The color-merchant, however, if he be unscrupulous or even only ignorant and careless, may work infinite mischief to art and artists; as it is, the artist is absolutely at his mercy. The old and salutary motto "*Caveat emptor*" scarcely applies in this case, for there are seldom any instant available means of testing or verifying the representations of the eager tradesman. Certain it is that every day some fresh pigment, guaranteed as absolutely stable and permanent, but of the properties of which the vendor himself may have had no adequate experience, is foisted on the helpless, unsuspecting painter. But this is nothing less than the most cruel and insufferable fraud, the consequences of which it seems scarcely necessary to dwell upon.

To this subject, however, the attention of eminent scientific authorities is now being directed; the field as yet has been but little tilled, and there is both honor and profit to be gleaned by the qualified and earnest laborer in it.

This matter lies, indeed, at the root of the question before us; it is for chemists and other scientists to deal with it effectually. The general subject of the preservation of the admirable works of past time in water-colors, however, is a many-sided one, and there is so great a wealth of illustration to be brought to bear upon it, that I shall probably find it impossible to entirely avoid trenching on the province of the scientist, or to steer quite clear of topics not strictly relevant to the specialty under consideration. . . .

Of course if it can be shown that some pigments, heretofore habitually made use of by water-color painters, are more or less fugacious, while others are stable and permanent, and if the two classes of colors have been made use of in the same picture, it stands to reason that any work so executed must, if freely exposed to the light of day, suffer gradual alteration and deterioration in an unequal manner. That is to say, portions of the work will retain their original force and purity of tint, while others will change in varying measure, or even vanish altogether. Obviously for any picture or drawing to be perennial — that is, unfading — if exposed to daylight, it would need to be entirely executed throughout with unalterable colors. Such a selection of tints is doubtless quite possible, but as water-color chromotography stands at present this would entail the abandonment of a great number of the most beautiful and serviceable pigments in current use. . . .

Of the pigments in present use, as might have been expected, the most stable are those of the mineral kingdom: many such colors are in fact perhaps absolutely unalterable in so far as the influence of light is concerned. On the other hand, the great majority of colors of vegetable and animal origin are more or less unstable and fleeting. I cannot indeed call to mind a single pigment in these categories which can be deemed absolutely permanent, while many of them have an existence scarcely less brief than that of the gaily-colored flowers whose tints they rival or surpass. The essentially non-permanent pigments of course are of every degree of mutability, some reasonably resistant and comparatively long-lived, others, so to speak, whose existence is to be measured by days and months rather than years or generations.

For this mutability, in whatever measure nevertheless, there is a sovereign remedy: as the active enemy is light so is the saviour darkness. It is probable even that the most evanescent pigments would be unchanged if kept entirely secluded from the light. It is needless to say, however, that drawings are not meant to be hidden under a bushel. . . .

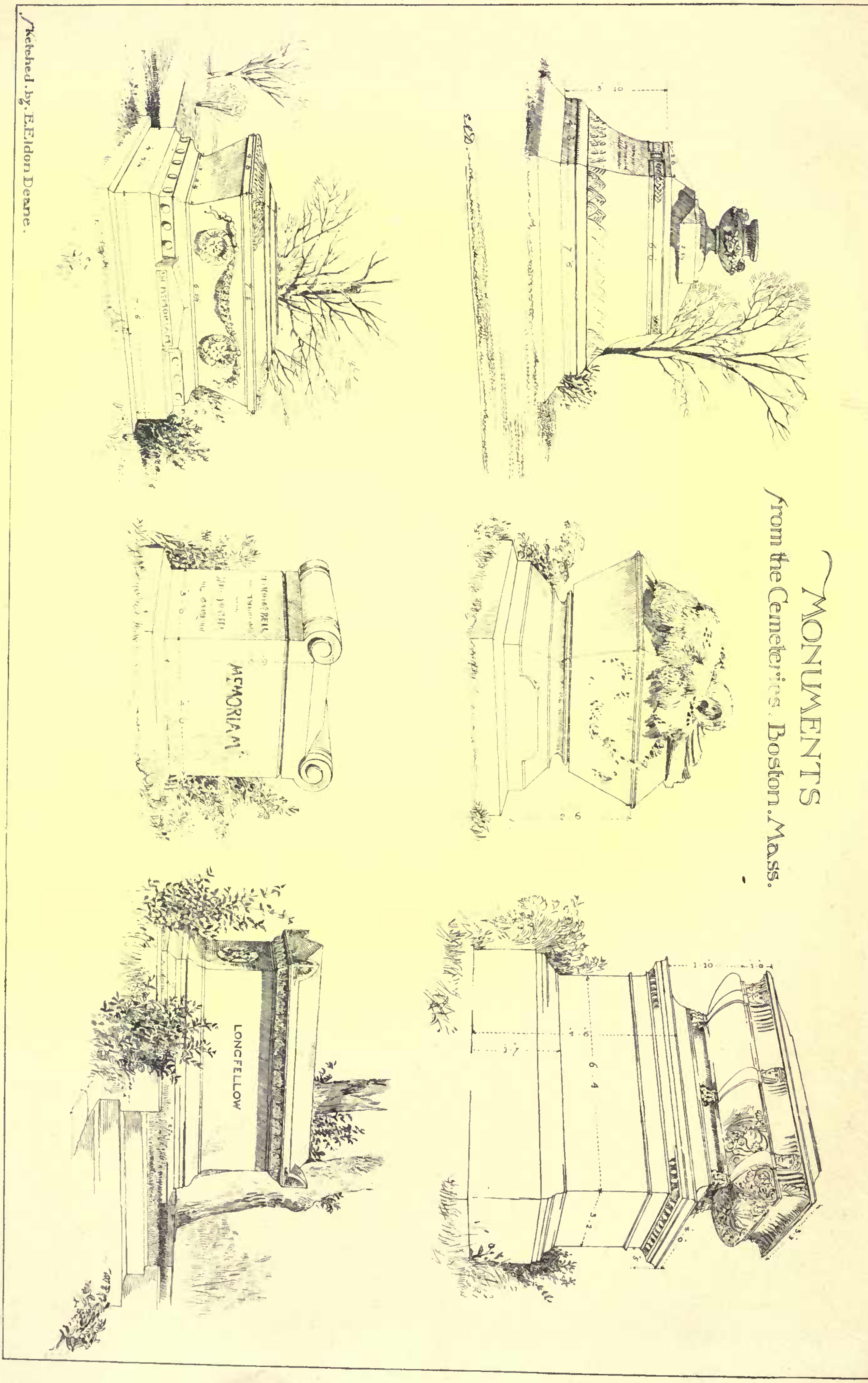
Water-color drawings, as the President of the Royal Water-Color Institute says, do not fade. He is speaking, be it noted, of antecedent works of English painters. Now let any one take one of these drawings, something of little value (for it is a question of an experiment *in corpore vili*), framed and glazed as usual. Let one-half of the drawing be covered with several sheets of stout paper pasted outside the glass, so as to form a perfectly opaque dark envelope, the other half remaining visible, as before. Let the drawing be then hung up and exposed to the light, say for a year. To suspend it face outwards in a winter casement is the best method. At the end of the period let the paper covering of the darkened half be removed; the result will, I apprehend, be convincing to the most incredulous person. The drawing will have become a dull work, one-half (the darkened one) remaining just as it was at first, whilst the other will have faded and become a pale, disjointed muddle, the two halves being as distinctly and sharply bounded as if a wet sponge had been passed over a moiety of the surface.

More striking still is another demonstration. Both experiments, by the way, have been frequently carried out, and the most careful notes taken of the results by more than one inquirer. It is this: Let a series of even flat tints of water-colors be laid in parallel strips or bands side by side on a sheet of paper, the colors chosen being such as are currently furnished by the color-merchant, and to which varying repute as to durability attaches. Take, on the one hand, the carbon blacks, Indian ink and lamp-black; simple oxides and ochres, such as Indian red, light red, burnt sienna, and yellow ochre; mineral and chemically-prepared colors, such as ultramarine, cobalt, and aureolin; and on the other hand, carmine, crimson lake, madder brown, sepia, bistre, indigo, sap-green, gamboge, gallstone and brown pink. Cut the sheet of paper in two across the series of parallel bands, so as to have two equal sets of tints. Keep one of them in the dark in a portfolio or betwixt the leaves of a book, and frame the other half and hang it up to the light in a window casement as before. At the expiration of the same period — though much less than a year would really suffice—let the two halves be brought together, again compared as in the former illustration. Whilst in some instances the tints in the respective halves will be found to be unchanged and exactly alike, others in the exposed portion will have absolutely vanished off the paper, or at best left but a faint and dirty stain, generally due to some extraneous impurity in the pigment, more permanent in its nature than the substance which it adulterated. . . .

As regards the relative durability of fugacious pigments, the action of direct sunlight is very rapid and notable. The exposure of any water-color drawing of Turner's, for instance, for a few days even to

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[1] From Cotman's "*Antiquities of Normandy.*"


MONUMENTS
from the Cemeteries. Boston. Mass.
Sketched by E. Eldon Deane.
LONGFELLOW
IN MEMORIAM
HELIOTYPE PRINTING CO. BOSTON.

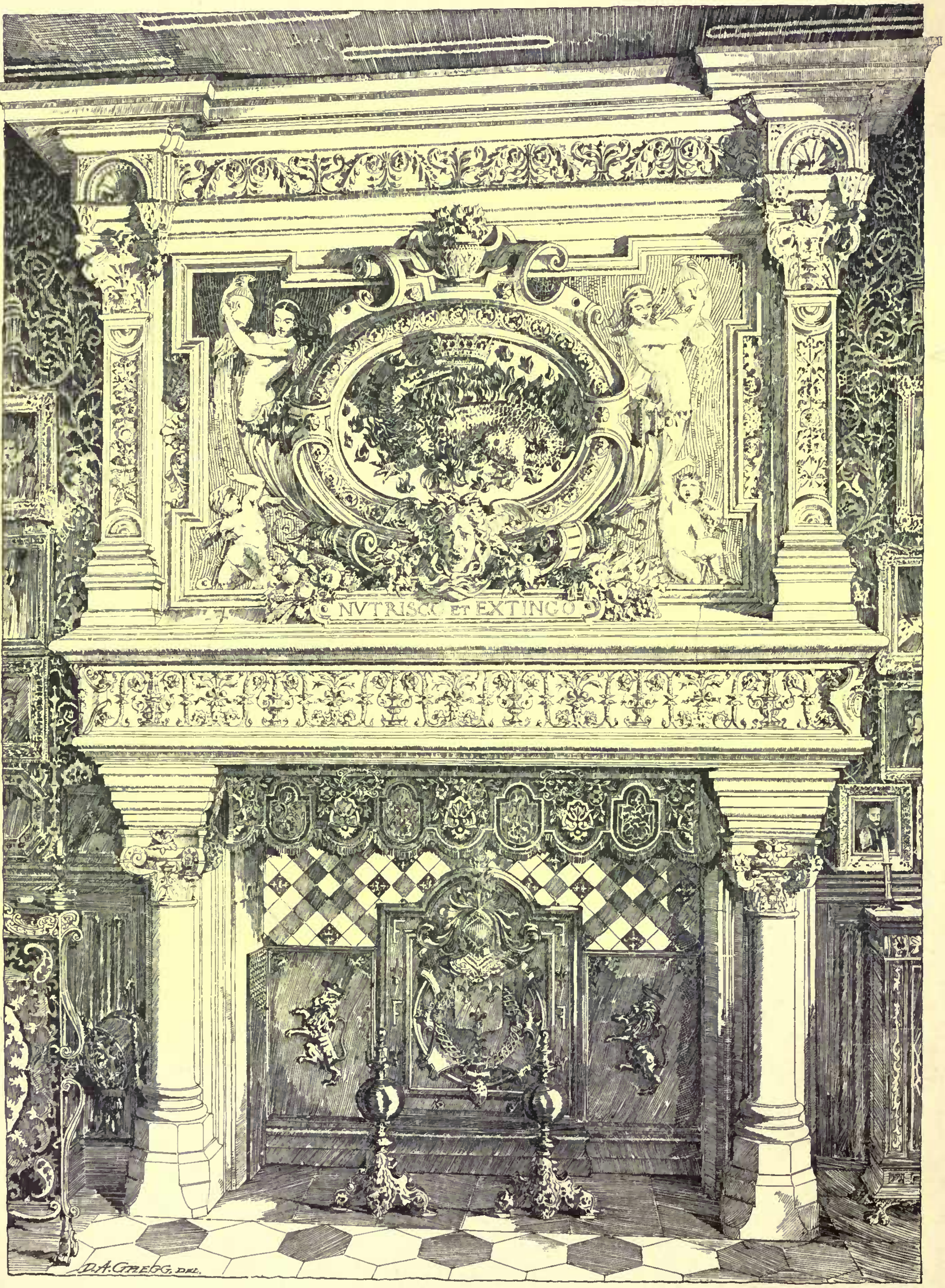


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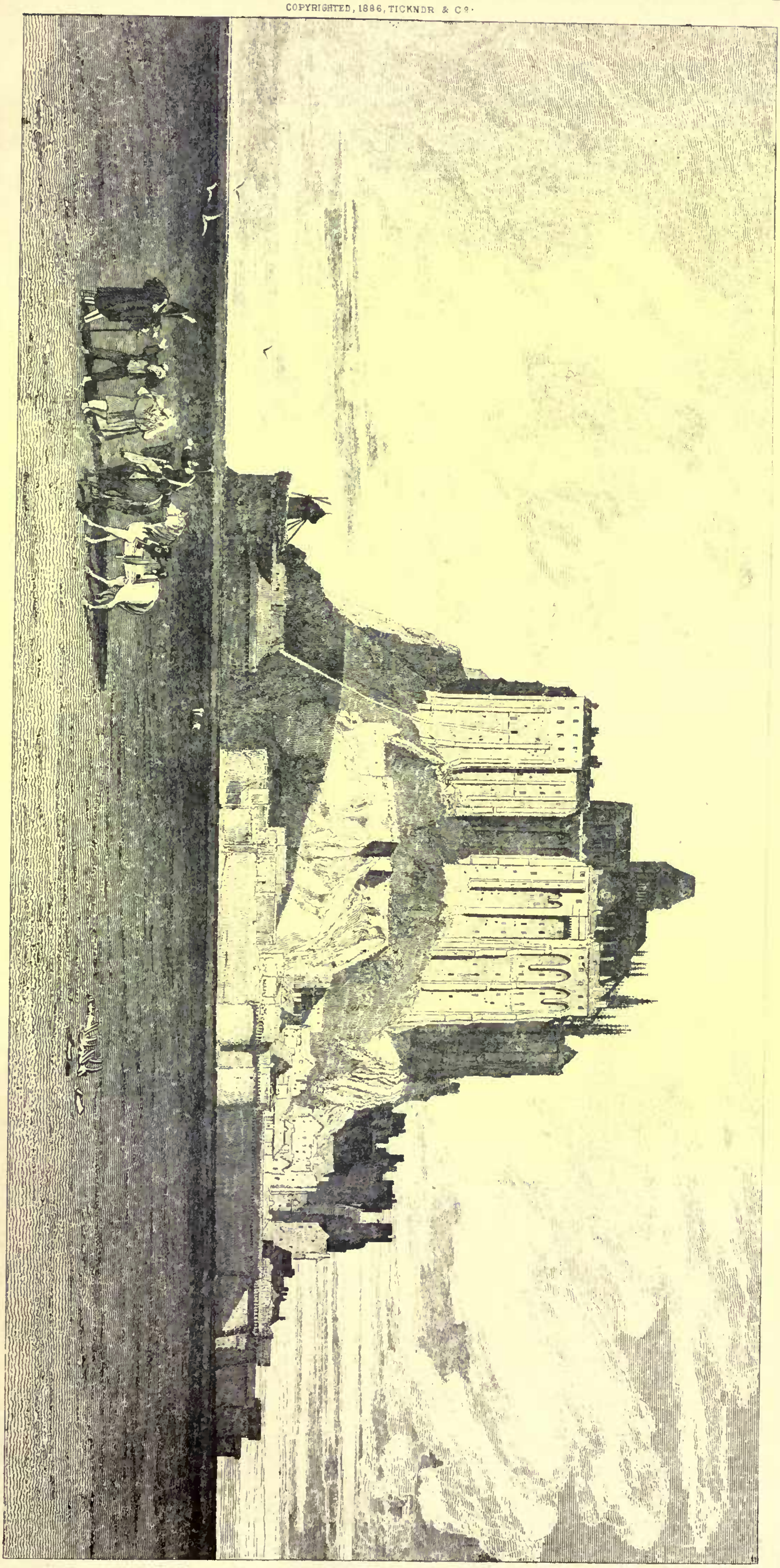
HELIOTYPE PRINTING CO. BOSTON

ine, Rome



HELIOTYPE PRINTING CO. BOSTON

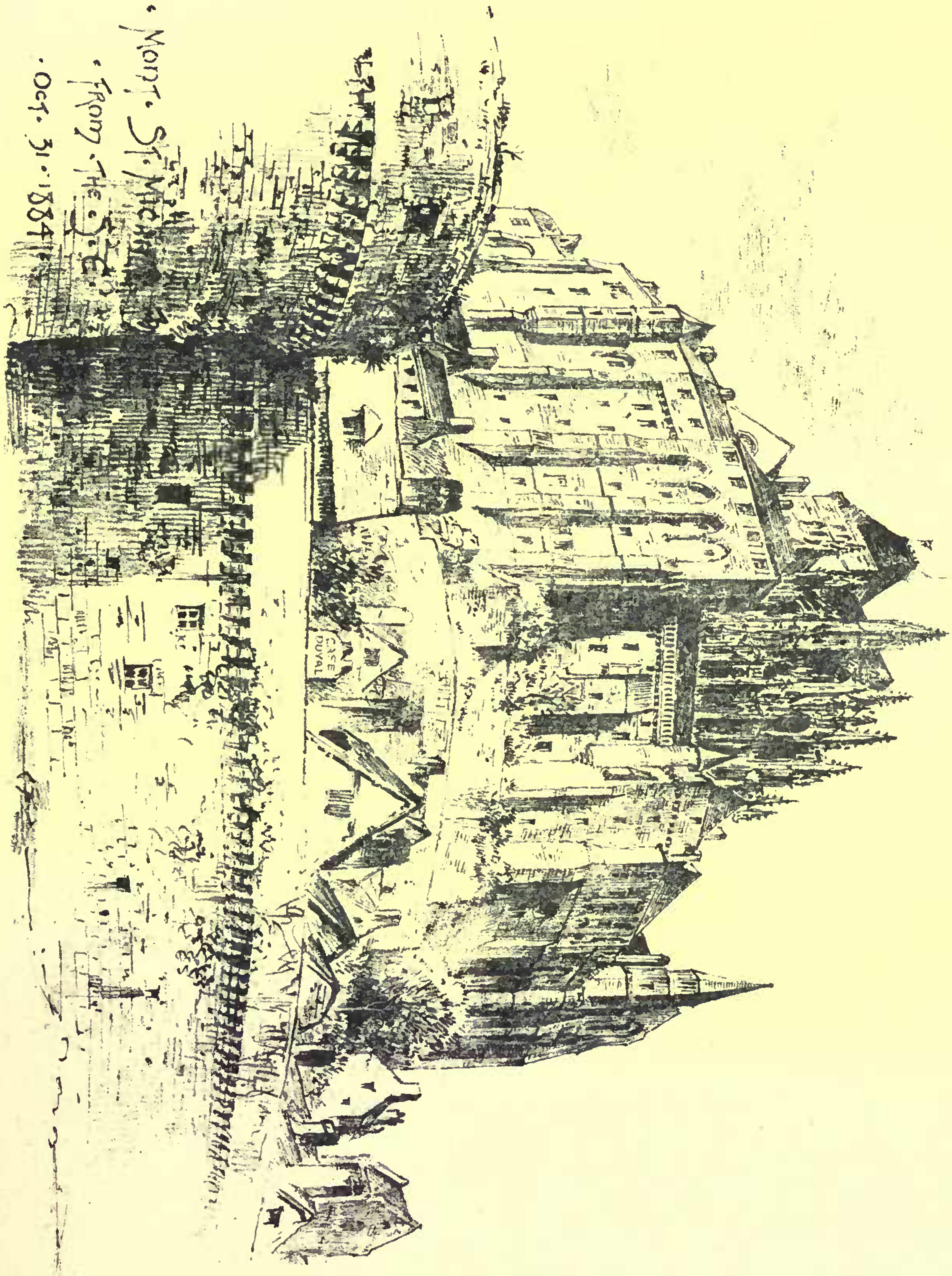
FIREPLACE, AZAY LE RIDEAU, FRANCE:



MOUNT ST MICHAEL.

HELIOTYPE PRINTING CO. BOSTON

AMERICAN ARCHITECT AND BUILDING NEWS, JULY 10 1886. No. 550.



direct sunlight would be sufficient to effect visible deterioration. Probably, indeed, more actual mischief may be caused by accidental exposure to the direct rays of the sun during so short a time even than would be the case in a series of years in the low half-light of an ordinary apartment. . . .

If absolute immunity from the bleaching effects of light could be secured for the pigments made use of, so many and weighty are the recommendations and advantages of the water-color process that I incline to think it would on the whole be even preferable as a means of art to oil painting.

Oil painting is a vastly more complex, cumbersome and tedious process, yet not necessarily a more durable one, and it may be questioned whether it has any inherent charms or physical capabilities which the water-color process, as carried out in these days, does not possess in equal measure. One thing, however, is certain, and it is desirable to place it in a clear light, whatever may be the especial drawbacks of the art, oil pictures are much less liable to deterioration from the influence of light than water-color drawings as they have been heretofore executed. There are, as a matter of fact, in oil painting counteracting agencies at work, tending to neutralize more or less, according to circumstances, the fading influence of light on the colors employed. One of these causes of greater stability in the pigments is probably the fact that they are employed in much greater volume than in water-color painting In the latter process the tints are for the most part mere washes or stains of impalpable tenuity; in oil paintings, on the contrary, the colors are often "piled up," or loaded, in quite measurable thickness; there is therefore a much greater substance of coloring matter for the light to act upon. More efficacious still, in the sense of preservation, is the fact that the coloring substances in oil painting are effectually enveloped or "locked up" with the oils and varnishes with which they are mixed, the separate particles being each surrounded with a protecting medium in the oil or varnish employed, vastly more solid and efficacious than the gum or size which binds together the coloring atoms in water-color painting. It is true that the oleo-resinous vehicles of oil-painting are in other ways themselves the causes and media of decay and alteration often as fatal to the artist's work as light is to water-color pictures, but to go into this matter would involve a separate treatise.

To the fading of pigments, however, these oleo-resinous enveloping vehicles oppose a direct resistance in another way. Whilst it is untrue—physically impossible, in fact—that simple water-color pictures can deepen in tone by age, it is, on the other hand, just as certain that oil pictures do become darker in aspect as time goes on; but this increasing depth of tone is caused in most instances mainly, and in every instance to a great extent, by the alteration in color of the oleo-resinous vehicles, not by any mutation of the pigments locked up in them, which latter, if they undergo any alteration at all, change in the sense of diminution, not increase, of intensity of tint. Oils and varnishes, though often quite colorless at first, undergo inevitable chemical changes, accelerated or retarded, superinduced, and even remedied again by modifying external influences. They absorb oxygen from the air, and a process analogous to the slow combustion of their particles takes place, the result being that the originally colorless vehicles gradually acquire a yellow or brown tint of varying degrees of intensity, and tend to become more or less turgid and opaque. This darkening process goes on most rapidly in the dark, and it is retarded or remedied again by re-exposure to light. A bleaching action, in fact, is then established. As I have intimated I am no authority on the actinic properties of light. The processes of photography have, however, made certain phenomena familiar to us. Everybody knows that it is the rays at the blue end of the spectrum which bleach and disintegrate, whilst the yellow and red rays are inert or protective. . . .

From this it results that whilst it is good for water-color drawings that they should be kept in the dark as much as possible, in portfolios rather than in glazed frames exposed to the light, it is, on the contrary, bad for oil pictures to hang them in dark corners, or for periods of time in shut-up rooms, the privation of light in those cases bringing about increasing darkness, dullness and opacity.

The action of the electric-light on water-color pigments is a question of much interest, and it is greatly to be desired that some competent scientific authority should practically investigate it. The feasibility of the exhibition of water-color drawings in our public collections literally depends upon a favorable solution of this question, for nothing is more certain than that the continuous exhibition of water-color drawings of past epochs by daylight inevitably entails their rapid, irremediable, and more or less complete and final deterioration. It is not unlikely that the white or bluish "arc" light would, though in a far less degree, be as destructive as the sun's light to mutable pigments; but the yellow "incandescent" light, on the contrary, would probably be found to exercise no perceptible bleaching influence. . . .

I observe that a recent writer on artists' pigments states that bistre and sepia are stable and reliable colors; but in this I differ from him entirely, and I apprehend that his observations and experiments have not extended over a sufficient range and length of time to have enabled him to ascertain the real truth of the matter. A very pertinent, and indeed amusing, instance in illustration of the fugacious nature of bistre and sepia (it is not easy, by the way, to decide in all cases which of these colors has been employed) occurs to me on the spur of the moment. In the Oxford University collection of drawings by the ancient masters is a large bistre pen-drawing, an elaborate copy of Michael Angelo's "Last Judgment," by a contemporary sixteenth-century artist. This drawing has been exposed to the light for a long period under glass, both at Oxford and before it came there; consequently it has waned and dwindled to a very pale and shadowy status. One figure in the composition, and the only, nevertheless retains its pristine force of tint, standing out like a dark rock against a vaporous sky. This is the figure of Charon, on the lower part of the composition, ferrying over condemned souls in his boat, and striking them with his oar. The fact is, the simple-minded artist, anxious to invest the evil one with superabundant terror, drew the grisly fiend with black pigment, doubtless Indian ink or lamp-black, and this color, being in its nature quite unchangeable, has stood its ground perfectly whilst all the rest of the work executed in bistre has almost faded off the paper. Thus the devil in this instance at all events remains just as black as he was painted!

Sir James Linton and others have alluded to the behavior of two pigments very frequently used in combination by the English water-colorists of the earlier part of the present century. These are Indian red and indigo, chiefly employed to form compound tints, in skies, distances, etc., of varying degrees of cool gray and purple. The strangest possible changes have taken place in many of the drawings in which these colors have been made use of. Cold gray skies with dark rolling clouds and distant purple mountains, for instance, have been utterly transformed and metamorphosed; they have often become bright "foxy" red: in short, the effect of brilliant, glowing sunsets has sometimes replaced that of the lowering skies originally depicted. . . .

I had intended to go especially into the question of the state of conservation of the drawings of the greatest of all water-colorists — Turner—but space warns me to be brief. Now I yield to no man in my admiration of that immortal artist, and the undeniable deterioration of his admirable drawings has long been a source of pain and regret to me. It was, then, with no little surprise that I found myself taken to task in the *Times* by no less an authority than Mr. Ruskin for having alluded to the faded condition of the beautiful Turner drawings, exhibited at the last Royal Academy winter exhibition. So far as I could understand the gist of Mr. Ruskin's letter it was to minimize or call in question the reality of the changes in the Turner's drawings, which nevertheless were only too obvious, and had notoriously been the subject of universal discussion by hundreds and thousands of sympathetic and disinterested observers.

In regard to this matter, however, I cannot do better than call in the assistance of a high authority who had repeatedly brought this subject to public notice years before, and that in so lucid and emphatic a manner as to dispense me entirely from adding anything further of my own. I shall, then, in bringing this paper to a conclusion, simply quote and fully endorse the statements and opinions so well expressed by my fellow laborer and predecessor in the field.

In the *Literary Gazette* of November 13, 1858, this writer, after describing the particular method of preserving the water-color drawings of Turner from the influence of light, says:

You will find that the officers of the Louvre and the British Museum refuse to expose their best drawings or missal pages to light, in consequence of ascertained damage received by such drawings as have been already exposed; and among the works of Turner I am prepared to name an example in which the frame having protected a portion whilst the rest was exposed, the covered portion is still rich and lovely in colors, whilst the exposed spaces are reduced in some parts nearly to white paper, and the color in general to a dull brown. . . .

Again, Turner's drawings, now national property,

were all kept by him in tight bundles or in clasped books; and all the drawings so kept are in magnificent preservation, appearing as if they had just been executed, whilst every one of those which have been in the possession of purchasers and exposed in frames, are now faded in proportion to the time and degree of their exposure; the lighter hues disappearing, especially from the skies, so as sometimes to leave hardly a trace of the cloud forms.[1] For instance, the great Yorkshire series is, generally speaking, merely the wreck of what it once was. That water-color drawings are not injured by darkness is also sufficiently proved by the exquisite preservation of missal paintings, when the books containing them have been little used.

Eighteen years after the above remarks appeared the same writer reaffirmed his convictions on the subject in a letter which appeared in the *Daily Telegraph* (July 5, 1876). He there tells us again of the proper way to preserve the drawings of Turner. They are to be framed and glazed, and kept, when they are not actually being looked at, in portable cabinets, where they are

never exposed to the light. . . . Thus taken care of, and thus shown, the drawings may be a quite priceless possession to the people of England for the next five centuries; whereas those exhibited in the Manchester Exhibition were virtually destroyed in that single summer. There is not one of them but is the mere wreck of what it was. I do not choose to name destroyed drawings in the possession of others; but I will name the vignette of the Plains of Troy in my own, which had half the sky baked out of it in that fatal year, and the three drawings of Richmond (Yorkshire), Egglestone Abbey and Langharne Castle, which have had, by former exposure to light, their rose colors entirely destroyed, and half of their blues, leaving nothing safe but the brown. . . . The public may, therefore, at their pleasure, treat their Turner drawings as a large exhibition of fireworks, see them explode, clap

[1] The cloud forms, which have disappeared from the drawings, may be seen in the engravings.

their hands, and have done with them; or they may treat them as an exhaustless library of noble learning.

Lastly, in a brief note which appeared in the *Daily Telegraph* of July 19, 1876, still the same writer repeats "that no water-color work of value should ever be constantly exposed to light."

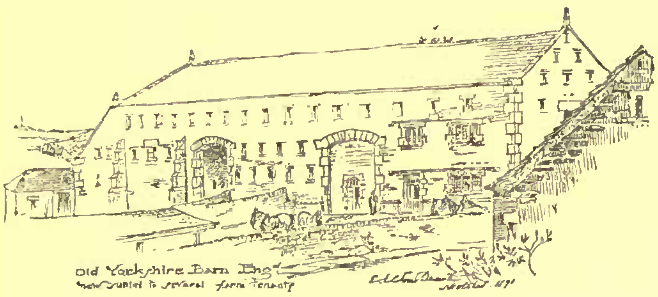
Now what is the name of this outspoken and, as I hold, most discerning writer? None other than *John Ruskin!*[1]

Surely, then, some counterfeit Ruskin must have penned these lines in the *Times* of April 14, this year:

Out of direct sunlight it (a water color drawing) will show no failing on your room wall till you need it no more. We may wisely spend our money for true pleasures that will last our time or last even a very little part of it; and the highest price of a drawing which contains in it the continuous delight of years cannot be thought extravagant as compared to that we are willing to give for a melody that expires in an hour.

Truly, the worth of a Turner drawing set against that of a single tune on the fiddle! — J. C. Robinson *in the Nineteenth Century.*

FLAME CONTACT.— A NEW DEPARTURE IN WATER HEATING.[2]



IT is my intention to prove to you, on theoretical ground, and also by experimental demonstration, in such a manner as will admit of no possible doubt, that the present accepted system of water heating by gaseous or other fuel, is a very imperfect means for an end, and is, both in theory and practice, essentially faulty. My statements may appear bold, but I come prepared to prove them in a manner which I think none of you will question, as the matter admits of the simplest demonstration. I will, in the first place, boil a specified quantity of water in a flat-bottomed vessel of copper; the time required to boil this you will be able to take for yourselves, as the result will be visible by the discharge of a strong jet of steam from the boiler. I will then take another copper boiler of the same form, but with only one-half the surface to give up its heat to the water, and will in this vessel boil the same quantity of water with the same burner in a little over one-half the time, thus about doubling the efficiency of the burner, and increasing the effective duty of the heating-surface nearly fourfold, by getting almost double the work from one-half the surface.

The subject is a comparatively new one, and my experiments are far from complete on all points; but they are sufficiently so to prove my case fully. As no doubt you are all aware, it is not possible to obtain flame contact with any cold, or comparatively cold surface. This is readily proved by placing a vessel of water with a perfectly flat bottom over an atmospheric gas burner; if the eye is placed on a level with the bottom of the vessel a clear space will be seen between it and the flame. I cannot show this space on a lecture table to an audience; but I can prove its existence by pasting a paper label on the bottom of one of the boilers, and exposing this to the direct impact of a powerful burner during the time the water is being boiled, and you will see that it comes out perfectly clean and uncolored. Now, it is well known that paper becomes charred at a temperature of about 400° Fahrenheit, and the fact my test-paper is not charred proves that it has not been exposed to this temperature, the flame being, in fact, extinguished by the cooling power of the water in the vessel. I need hardly remind you that the speed with which convected or conducted heat is absorbed by any body is in direct ratio to the difference between its own temperature and that of the source of heat in absolute contact with it; and, therefore, as the source of the heat taken up by the vessel is nothing but unburnt gases, at a temperature below 400° Fahrenheit, the rate of absorption cannot, under any circumstances, be great, and the usual practice is to compensate for this inefficiency by an enormous extension of surface in contact with the water, which extension I will prove to you is quite unnecessary.

You will see I have here a copper vessel with a number of solid copper rods depending from the lower surface; each rod passes through into the water space and is flattened into a broad head, which gives up its heat rapidly to the water. My theory can be stated in a few words: The lower ends of the rods, not being in close communication with the water, can, and do attain a temperature sufficiently high to admit of direct flame contact, and as their efficiency, like that of the water surface, depends on the difference between their own temperature and that of the source of heat in absolute contact with them, we must, if my theory is correct, obtain a far greater duty from them. I do not wish you would take anything for granted; and although the surface of the rods, being vertical, can only be calculated for evaporating power at one-half that of a horizontal surface, as is usual in boiler practice, my margin of increased duty is so great that I can afford to ignore this, and to take the whole at what its value would be as horizontal surface, and still obtain a duty fifty per cent greater from a surface which is the same in area as the flat-bottomed vessel on the fireside, but having only one-third the surface area in contact with the water. I do not, of course, profess to obtain more heat from the fuel than it contains, but simply to utilize that heat to the fullest possible extent by the use of heating surfaces beyond comparison smaller than what have been considered necessary, and to prove not only that the heating surface can be concentrated in a very small area, but also that its efficiency can be greatly increased by preventing close water contact, and so permitting combustion in complete contact with a part of the heating surface. I will now boil forty ounces of water in this flat-bottomed copper vessel, and, as you will see, sharp boiling begins in three minutes fifteen seconds from the time the gas is lighted. The small quantity of steam evolved before this time is of no importance, being caused partly by the air driven off from the water and partly from local boiling at the edges of the vessel, owing to imperfect circulation. On the bottom of this vessel is pasted a paper label which you will see is untouched by the flame, owing to the fact that no flame can exist in contact with a cold surface. It may be thought, that, owing to the rapid conducting power of copper, the paper cannot get hot enough to char. This is quite a mistake, as I will show you by a very curious experiment. I will hold a small plate of copper in the flame for a few seconds, and will then hold it against the paper. You will see that, although the copper must of necessity be at a temperature not exceeding that of the flame, it readily chars the paper.

We can, by a modification of this experiment, measure the depth of the flameless space, as the copper, if placed against the paper before it has time to be previously heated, will, if not thicker than one-fortieth of an inch, never become hot enough to discolor the paper, showing that the flame and source of heat must be below the level of a plate of metal this thickness. In repeating this experiment I must caution you to use flour paste, not gum, which is liable to swell and force the paper past the limit of the flameless space, and also to allow the paste to dry before applying the flame, as the steam formed by the wet paste is liable also to lift the paper away and force it into the flame. I will now take this vessel, which has only one-half the surface in contact with the water, the lower part being covered with copper rods, three-sixteenths of an inch in diameter, one-half inch centres apart, and one and one-half inches long, and you will see that with the same burner as before, under precisely the same conditions, sharp boiling takes place in one minute fifty seconds, being only thirteen seconds more than half the time required to produce the same result with the same quantity of water as in the previous experiment. Although the water surface in contact with the source of heat is only one-half that of the first vessel and the burner is the same, we can see the difference not only in the time required to boil the forty ounces of water, but also in the much greater force and volume of steam evolved when boiling does occur. With reference to the form and proportions of the conducting rods, these can only be obtained by direct experiment in each case for each distinct purpose. The conducting power of a metallic rod is limited, and the higher the temperature of the source of heat, the shorter will the rods need to be, so as to insure the free ends being below a red heat, and so prevent oxidation and wasting. There are also other reasons which limit the proportions of the rods, such as liability to choke with dirt and difficulty of cleaning, and also risk of mechanical injury in such cases as ordinary kettles or pans; — all these requirements need to be met by different forms and strengths of rods to insure permanent service, and, as you will see further on, by substituting in some cases a different form and type of heat conductor.

To prove my theory as to the greater efficiency of the surface of the rods in contact with the flame as against that in direct contact with the water, I have another smaller vessel which, including the rods, has the same total surface in contact with the flame, but only one-third the water surface as compared with the first experiment. Using again the same quantity of water and the same burner, we get sharp boiling in two minutes ten seconds, being an increase of duty of fifty per cent, with the same surface exposed to the flame. The rods in the last experiment form two-thirds of the total heating surface, and if we take, as I think for some careful experiments we may safely do, one-half the length of the rods to be at a temperature which will admit of direct flame contact, we have here the extraordinary result that flame contact with one-third of the heating-surface increases the total fuel duty on a limited area fifty per cent. This really means that the area in contact with the flame is something like six times as efficient as the other. In laboratory experiments it is necessary not only to get your result, but to prove your result is correct, and the proof of the theory admits of ready demonstration in your own laboratories, although it is unfit for a lecture experiment, at all events, in the only form I have tested it.

If you will take two ordinary metal ladles for melting lead, cover the lower part of one of these with the projecting rods or studs and leave the other plain, you will find, on melting a specified quantity of metal in each, that the difference in duty between the two is very small. The slight increase may be fully accounted for by the difference in the available heating surface reducing the amount of waste

[1] For further and equally-explicit utterances in the same sense, see *Arrows of the Chase*, 1880, section 4.

[2] By Thomas Fletcher, F.S.C. Gas Institute Meeting, London, June 9, 1886.

heat passing away, and this proves that flame contact, and therefore quick absorption of heat, takes place on plain surfaces as soon as these are above a certain temperature, which, in a metal ladle, very soon occurs. What the temperature is which admits of flame contact I have, as yet, not been able to test thoroughly, and it will need some consideration how the determination of this is to be correctly made; at the same time it is a question of physics which should be capable of being answered. Let us now take the other side of the question. If the efficiency of a surface depends on flame contact, there must, of course, be flame, or, at least, gases of an extremely high temperature, and we therefore cannot expect this extraordinary increase of efficiency in any part of our boiler except where flame exists, and if these projections are placed in a boiler, anywhere except in contact with flame, their efficiency must be reduced to that of ordinary heating surface. They are, of course, useful, but only in the same way as ordinary flue surface.

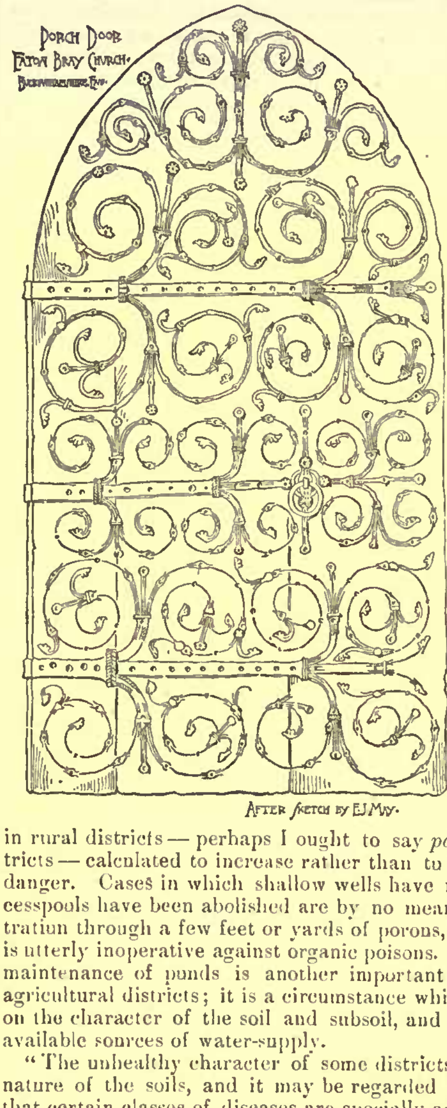
When we come to boilers for raising steam, which have to stand high pressures, we come to other difficulties of a very serious nature, which require special provision to overcome them. To put such rods as I have referred to in a boiler-plate necessitates the plate being drilled all over with holes, causing a dangerous source of weakness, as the rods cannot be used as stays; further than this, they would render really efficient examination a matter of extreme difficulty, and would be liable to give rise to frequent and almost incurable leakages; but there is, fortunately, a very simple way to overcome this difficulty. I have found that rods or points, such as I have described, are not necessary, and that the same results can be obtained by webs or angle-ribs rolled in the plates. My experiments in this direction are not complete, and at present they tend to the conclusion that circular webs, which would be of the greatest efficiency in strengthening the flues, are not so efficient for heating as webs running lengthways with the flue, and in a line with the direction of the flame. This point is one which I am at present engaged in testing with experimental boilers of the Cornish and Lancashire type, and, as we have in gas a fuel which renders every assistance to the experimenter, it will not take long to prove the comparative results obtained by the two different forms of web. Those of you who have steam boilers will, no doubt, know the great liability to cracking at the rivet holes in those parts where the plates are double; this cracking, so far as my own limited experience goes, being usually, if not always, on the fire side, where the end of the plate is not in direct contact with the water, where it is, in fact, under the conditions of one of the proposed webs. I think we may safely come to the conclusion that this cracking is caused by the great comparative expansion and contraction of the edge of the plate in contact with the fire, and it will probably be found that if the plates are covered with webs, the whole of the surface of the plates will be kept at a higher and more uniform temperature, and the tendency to cracks at the rivet-holes will be reduced. This is a question not entirely of theory, but needs to be tested in actual practice.

There is another point of importance in boilers of the locomotive class, and those in which a very high temperature is kept in the fire-box, and this is the necessity of determining by direct experiment the speed with which heat can safely be conducted to the water without causing the evolution of steam to be so rapid as to prevent the water remaining in contact with the plates, and also whether the steam will or will not carry mechanically with it so much water as to make it objectionably wet, and cause priming and loss of work by water being carried into the cylinders. I have observed, in the open boilers I use, that when sufficient heat is applied to evaporate one cubic foot of water per hour from one square foot of boiler surface, the bulk of the water in the vessel is about double, and that the water holds permanently in suspension a bulk of steam equal to itself.

I have, as yet, not had sufficient experience to say anything positively as to the formation or adhesion of scale on such surfaces as I refer to, but the whole of my experimental boilers have, up to the present, remained bright and clean on the water surface, being distinctly cleaner than the boiler used with ordinary flat surfaces. It is, I believe, generally acknowledged that quick heating and rapid circulation prevents, to some extent, the formation of hard scale, and this is in perfect accord with the results of my experiments.

The experiments which I have shown you, I think, demonstrate beyond all question that the steaming power of boilers in limited spaces, such as our sea-going ships, can be greatly increased; and when we consider how valuable space is on board ship, the matter is one worthy of serious study and experiment. It may be well to mention that some applications of this theory are already patented. I will now show you, as a matter of interest, in the application of coal gas as a fuel, how quickly a small quantity of water can be boiled by a kettle constructed on the principle I have described, and to make the experiment a practical one I will use a heavy and strongly-made copper kettle which weighs six and one-half pounds, and will hold, when full, one gallon. In this kettle I will boil a pint of water, and, as you see, rapid boiling takes place in fifty seconds. The same result could be attained in a light and specially-made kettle in thirty seconds, but the experiment would not be a fair practical one, as the vessel used would not be fit for hard daily service, and I have therefore limited myself to what can be done in actual daily work rather than laboratory results, which, however interesting they may be, would not be a fair example of the apparatus in actual use at present.

THE GEOLOGY OF THE EARTH'S SURFACE IN ITS SANITARY ASPECT.



FROM an interesting paper read by Professor W. Fream at a recent meeting of the Surveyors' Institution [London], on "The Geology of the Surface in its Practical Aspects," the following passages are taken: —

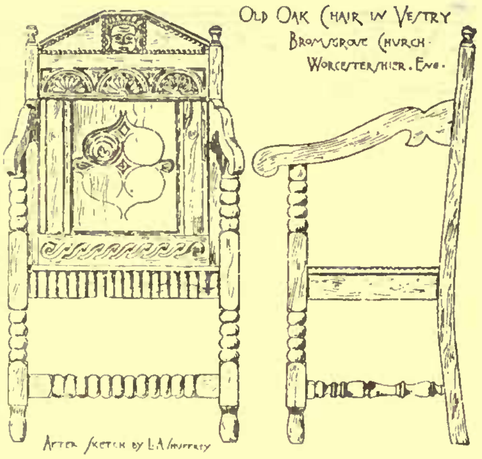
"A full knowledge of the nature and distribution of the superficial deposits is a necessary preliminary to a thorough comprehension of local conditions favorable to water supply and drainage. Water derived from surface springs is always more or less open to suspicion, and the recent progress of medical and sanitary science has indicated clearly enough the nature of the dangers which may lurk in drinking-water obtained from such sources. The growing density of the population is, even in rural districts — perhaps I ought to say *particularly* in rural districts — calculated to increase rather than to diminish this source of danger. Cases in which shallow wells have run dry when adjacent cesspools have been abolished are by no means hypothetical, and filtration through a few feet or yards of porous, sandy or gravelly rock is utterly inoperative against organic poisons. The establishment or maintenance of ponds is another important matter, especially in agricultural districts; it is a circumstance which is largely dependent on the character of the soil and subsoil, and on the nature of the available sources of water-supply.

"The unhealthy character of some districts is associated with the nature of the soils, and it may be regarded as an established fact that certain classes of diseases are specially addicted to certain soils. On soils pervious to water the prevailing diseases are of the enteric or typhoid type; on impervious soils they are consumption and other lung diseases, and rheumatism. In the former case foul drinking-water obviously suggests itself as the medium of contagion, for when the level of the ground water is low, percolation is free, and then it is that most of the zymotic diseases are rife. Professor Pettenkofer's continuous daily observations on the height of the ground water at Munich demonstrated that when the ground water fell the death rate rose, typhoid fever in particular inducing fatal results. Not long ago Mr. Baldwin Latham prepared a diagram showing the connection between low ground-water and typhoid fever at Croydon. The ground-air, moreover, is as important from a hygienic point of view, particularly in relation to dwelling-houses, as is the ground water. The quantity of ground air varies with the nature of the soil, being least in clays, more in loams, and most in sands or gravels; it varies, also, with the quantity of moisture in the soil, and, in any given soil, it approaches the maximum when the ground-water is at its lowest. The circulation of air in the soil is greatly influenced by the temperature and pressure of the atmosphere, and a falling barometer is a danger signal, bidding us beware lest the offensive gaseous emanations from defective drains and cesspits should be given off at the surface of the ground, and perchance beneath the dwelling-rooms of a house, where the draught caused by fires will aid in determining the course of the effluvia. Dr. J. W. Tripe, Medical Officer of Health for Hackney, has traced the path of injurious gases through more than thirty feet of loose soil. Some years ago, Mr. G. J. Symons, F. R. S., Secretary of the Royal Meteorological Society, advocated the collection, by a commission of experts, of a complete statistical record of the health rate, death rate, geology, climate, water-supply, drainage, and general conditions of all our mineral-water, sea-bathing, or pure-air resorts; and he maintains that the collection of such statistics would have both direct and indirect beneficial effects infinitely beyond the cost of the inquiry. The temperature both of soil and of ground-water is obviously a matter of importance.

"The reason that sandy and gravelly soils have usually received town populations before clayey ones — a fact which was well illustrated during the settlement of the metropolitan districts—is that, on the former, water was as easy to obtain as, on the latter, it was

frequently difficult; the sanitary differences between the two kinds of soil are branches of very recent knowledge. So intimate is the relation between the geology of the surface and the conditions controlling health, that the University of London, in its 'Examination in Subjects relating to Public Health,' which is open only to its graduates in medicine, requires candidates to give evidence of a knowledge of 'Geology, as regards general knowledge of Rocks, their conformation and chemical composition, and their relation to underground Water, and to drainage and sources of Water-supply.' Among legislative enactments, the Rivers Pollution Prevention Act is not without interest and significance in the same connection."

A PHARAOH'S HOUSE FOUND IN A CORNER OF THE DELTA.



A VERY curious and interesting discovery has been made in the loneliest and dreariest corner of the Northeastern Delta. In a land where previous explorers have found only temples and tombs — the monuments of an extinct faith and the graves of a dead nation —Mr. Flinders Petrie has lighted upon the ruins of a royal palace. Not a palace of the dubious pre-historic Byzantine sort, but a genuine and highly-respectable structure, with an unblemished pedigree and a definite place in the history of four great nations. In a word, the fortunate finder of Naukratis has for the last six or eight weeks been working upon a large mound, or group of mounds, called Tell Defenneh, which Egyptologists and historians have long identified with the "Pelusiac Daphnæ" of the Greek writers and the "Taphanhes" of the Bible. Here he has discovered the ruins of that very palace to which, as recorded in the Book of the Prophet Jeremiah (chapter 43), Johanan, the son of Kareah, followed by "all the Captains of the forces" and "the remnant of Judah," brought the fugitive daughters of Zedekiah, then a dethroned and mutilated captive in Babylon. This flight of the Hebrew Princesses took place about B. C. 585, during the reign of Ua-ab-Ra (twenty-sixth Egyptian dynasty), whom the Hebrews called Hophra and the Greeks Apries. The Pharaoh received them with hospitality. To the mass of Jewish immigrants he granted tracts of land extending from Taphanhes to Bubastis, while to the daughters of Zedekiah, his former ally, he assigned this royal residence, which the Bible calls "Pharaoh's house in Taphanhes."

At the time when these events happened the whole of this part of the Delta, to the westward as far as Tanis (San), to the southward as far as the Wady Tûmilât, was a rich pastoral district, fertilized by the annual overflow of the Pelusiac and Tanitic arms of the Nile. It is now a wilderness, half marsh, half desert. Toward the eastern extremity of this wilderness, in the midst of an arid waste relieved by only a few sand-hills overgrown with stunted tamarisk bushes, lie the mounds of Defenneh. Far from roads, villages, or cultivated soil, it is a place which no traveller goes out of his way to visit, and which no explorer has hitherto attempted to excavate. Sixteen miles of marsh separate it on the one side from Tanis, while on the other the horizon is bounded by the heron-haunted lagoons of Lake Menzaleh and the mud-swamps of the plain of Pelusium. The mounds consist of three groups situate from half a mile to a mile apart, the intermediate flat being covered with stone-chips, potsherds, and the remains of brick foundations. These chips, potsherds, and foundations mark the site of an important city in which the lines of the streets and the boundaries of two or three large inclosures are yet visible. Two of the mounds are apparently mere rubbish heaps of the ordinary type; the third is entirely composed of the burned and blackened ruins of a huge pile of brick buildings, visible, like a lesser Birs Nimroud, for a great distance across the plain. Arriving at his destination toward evening, footsore and weary, Mr. Petrie beheld this singular object standing high against a lurid sky and reddened by a fiery sunset. His Arabs hastened to tell him its local name, and he may be envied the delightful surprise with which he learned that it is known far and near as "El Kasr el Bint el Yahudi — the Castle of the Jew's Daughter."

Seeing at once that the interest of the place centred in this "Kasr," Mr. Petrie forthwith pitched his camp at the foot of the slope, between the tamarisks and the right bank of a brackish canal which intersects the outskirts of the mound and expands somewhat higher up into two good-sized lakes. The place being literally in the midst of an uninhabited desert, he had brought with him a patriarchal following of Nebesheh folk — men, boys, and girls — some forty souls in all, to say nothing of camels and baggage. Want of space forbids us to follow Mr. Petrie step by step in his work of exploration; enough that he at once concentrated his forces upon the "Kasr," which has now been so thoroughly cleared out and cleared up that not only its architectural structure, but its history has been rescued from oblivion.

The building was first a stronghold, quadrangular, lofty, massive; in appearance very like the keep of Rochester Castle. It contained sixteen square chambers on each floor, both the outer walls and partition walls being of enormous strength. It is, of course, impossible to guess of how many stories it was originally composed; but the bulk of the mound consists of its débris. This stronghold was built by Psammetichus I, whose foundation deposits (consisting of libation vessels, corn-rubbers, specimens of ores, model bricks, the bones of a sacrificial ox and of a small bird, and a series of little tablets in gold, silver, lapis-lazuli, jasper, cornelian, and porcelain, engraved with the royal name and titles) have been discovered by Mr. Petrie under the four corners of the building. The name of the founder being thus determined, we at once know for what purpose the castle was erected. What the excavations have disclosed is, however, still more curious. And here it is necessary to remember that the place is not merely a ruin, but a burned ruin, the upper portions of which have fallen in and buried the basements. Furthermore, it was plundered, dismantled, and literally hacked to pieces before it was set on fire. The State rooms, if one may use so modern a phrase, were lined with slabs of fine limestone covered with hieroglyphic inscriptions, bas-relief figures of captives and the like, most delicately sculptured and painted. These now lie in heaps of splintered fragments, from among which Mr. Petrie has with difficulty selected a few perfect specimens. The whole place, in short, tells a tale of rapine and vengeance. It would be idle, under these circumstances, to hope for the discovery of objects of value among the ruins. Moreover, it was only in the basement-chambers, where things might have fallen through from above, or have been left *in situ*, that there seemed to be any prospect of "finds" for the explorer. Now, the basements were the offices, and some of these offices have been found intact under the superincumbent rubbish. There is certainly nothing very romantic in the discovery of a kitchen, a butler's pantry, and a scullery. It would be more satisfactory to find a throne-room or a treasure-chamber. Yet even these domestic *arcana* become interesting when they form part of an ancient Egyptian palace of twenty-five hundred and fifty-two years ago. The kitchen of "Pharaoh's house in Tahpanhes" is a big room, with recesses in the thickness of the walls, which served for dressers. Here some fourteen large jars and two large flat dishes were standing in their places, unharmed amid the general destruction. A pair of stone corn-rubbers, a large iron knife, various weights, and three small flat iron pokers — or possibly spits — were also found in this room. The butler's pantry, it need scarcely be said, was the room to which wine jars were brought from the cellars to be opened. It contained no amphoræ, but hundreds of jar lids and plaster amphoræ stoppers, some stamped with the royal ovals of Psammetichus, and some with those of Necho, his successor. Here, also, was found a pot of resin. The empty amphoræ, with quantities of other pottery, mostly broken, were piled in a kind of rubbish depot close by. Some of those amphoræ have the lute-shaped hieroglyph signifying "nefer" (good) scrawled three times in ink upon the side, which, not to speak it profanely, may probably indicate some kind of "XXX" for Pharaoh's consumption. Most curious of all, however, is a small room evidently sacred to the scullery maid. It contains a recess with a sink, a built bench to stand things upon, and recesses in the wall by way of shelves, in which to place what has been washed up. "The sink," writes Mr. Petrie, "is formed of a large jar with the bottom knocked out and filled with broken potsherds placed on edge. The water ran through this, and then into more broken pots below, placed one in another, all bottomless, going down to the clean sand some four or five feet below." The potsherds in this sink were covered with organic matter and clogged with fish-bones.

In other chambers there have been found large quantities of early Greek vases, ranking from B. C. 500 to B. C. 600, some finely painted with scenes of gigantomachia, chimeras, harpies, sphinxes, processions of damsels, dancers, chariot races, and the like, nearly all broken, but many quite mendable; also several big amphoræ with large loop handles, quite perfect. A sword handle with a wide curved guard, some scale armor, bronze rings, amulets, beads, seals, small brass vessels, and other minor objects of interest have also turned up, and two rings engraved with the titles of a priest of Amen. Some small tablets inscribed with the name of Amasis (Ahmes II), and a large bronze seal of Apries (Hophra), are important, inasmuch as they complete the name-links in the historic chain of the twenty-sixth Dynasty. . . .

To identify Jeremiah's stones (unless he had first inscribed them, which is unlikely) would, of course, be impossible. Yet Mr. Petrie has looked for them diligently, and turned up the brickwork in every part. Some unknown stones have, indeed, been dug out from below the surface, and it is open to enthusiasts to identify them, or not, as they think fit, but about the "Balât" it is scarcely possible that there should be a difference of opinion. Did Nebuchadrezzar really come to Taphanhes and spread his royal pavilion on that very spot, and was Jeremiah's prophecy fulfilled? Egyptian inscriptions say that he came, and that Apries defeated him; Babylonian inscriptions state that he conquered, and the truth is hard to discover. At all events, there are three clay cylinders of Nebuchadrezzar in the Museum at Boulak inscribed with the great king's name, titles, parentage, etc., which there is much reason to believe were found a few years ago at this place, and not as the Arab sellers stated, at Tussûn,

on the isthmus. Such cylinders were taken with him by Nebuchad rezzar in his campaigns for the purpose of marking the place where he planted his standard and throne of victory.—*London Times, June* 18.

COMMUNICATIONS

[*We cannot pay attention to the demands of correspondents who forget to give their names and addresses as guaranty of good faith.*]

SIR EDMUND BECKETT AGAIN.

NEW YORK, June 28, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—For years there has been no better fun than reading Sir Edmund Beckett's lucubrations on art, particularly in its architectural field. He muddles whatever he handles with such stolid and thorough self-complacency that one is inevitably reminded of those very much mixed metaphors of Sir Boyle Roche, which have so long been prominent in the stock of our recurrent Joe Millers. It never occurred to me that his last pronunciamento was any more worth serious treatment than many preceding ones; but Mr. Leopold Eidlitz has thought it worth while to give it such treatment in your issue of Saturday, though, to be sure, it gives the latter an opportunity to insist, in a quite piquant way, on several self-evident points, to the advantage no doubt of some of your younger readers.

Sir Edmund has lately, it is understood, been posing for a peerage, and to gain his end naturally trades on the chief capital he has, *i. e.*, his reputation (however fairly or unfairly earned) among his official superiors for saving the public treasury from the wilfulness and extravagance of naughty architects; though indeed, when he talks of his walls nine feet thick it does look a little as if he might have fallen into over-lavish ways himself. But, it seems, "he likes walls like himself." He certainly does resemble dead stone walls, and very thick ones in more respects than one. It is really much to be feared that our obfuscated baronet in having "to do a good deal with architects" has necessarily received too many snubs from competent and self-respecting ones to make his word worth much when speaking of them *en masse.*

There are of course architects and architects, as there are competent, conscientious and modest lecturers and lecturers who for their own purposes injuriously transcend their "duty — all that is formally required of them," by venturing to instruct youth in what they convict themselves of knowing nothing or very little indeed about; and by poisoning their minds against a whole profession. It is certainly true that the mediæval architects overrated the functions of the arch, which, as the Arabs say, "never sleeps;" and that much of the ecclesiastical work was of poor construction, probably because it was controlled by superstitious, self-sufficient, sinecure clergy, having as agents perfunctory, officious, greedy commissioners-of-works *et hoc*, always in the way to show their self-importance and to absorb the funds, and thus prevent the real designers and experts from carrying out their plans properly. A few years ago, under the guidance of the contractor for repairs, I went over the uncovered foundation and other work of portions of Peterborough Cathedral, and found in it as thorough "scamp" work as I ever encountered in any modern construction. At another time, I saw unmistakable evidence of similar dishonest work in an ancient Italian cathedral, that of Pavia, I think. But no one believes that "the whole Institute of [British] Architects" recently wanted Sir Edmund Beckett to build a nine-inch wall where a nine-foot one was constructionally requisite; nor even that any middle-aged abbot of St. Alban's or his chief commissioner of works was stupid enough or money-grubbing enough to make a mistake covered by a discrepancy so wide, whatever superficial evidence to that effect may exist, after the changes of centuries, to the apprehension of the *dilettante* and placeman. It is much safer to assume that Sir Edmunds' "large arch" is really a small one, and that he does not understand the constructive laws for carrying thrust safely from one point to another, or the adequacy of buttresses and other abutments. For in nearly everything the Press has given us of Sir Edmund Beckett, he only affords another proof of the fact that every man, however great in his own estimation, is a fool outside of his rut (though of course some ruts are wider than others), as was very apparent when Professor Huxley gave an astonished world his surprising views on college façades, and more recently with other scientists and philosophers those on the Irish question.

But after all it is to be feared that Sir Edmund may conscientiously have some ground, not for his impertinent aspersions of a whole profession, the functions of which so complex, exacting and widely inclusive, and the finer qualifications for and results of which he is obviously incompetent to understand or deal with, but, for his evident impression that some architectural practitioners need watching as regards some points; just as chiefs of public work, commissions and *soi-disant* art lecturers need with respect to others, as much watching as may be convenient. And it would be quite in order for the (it is to be hoped) not yet exhausted pen of Mr. Leopold Eidlitz to give us some suggestions as to the best way of removing the impression, rife among the more unthinking portion of the public that—just as they assume that every clergymen is a hypocrite and every physician a quack, so—every architect is necessarily a mere draughtsman of pretty lines, and a spendthrift, for purposes of show and self-glorification, of other folks' money. Doubtless Mr. Eidlitz's facile pen could easily brush away such injurious assumptions, and produce before the bowed head of Sir Edmund and to the admiration of the public, those shining examples of practitioners who not only fill the bill—in his estimation — at all professional points, but in the moral field, which is always the final test-ground with any civilized community, show no taint or flaw whatever, no vanity or self-assumption, no egotism or greed, no undermining, no treachery; but only the keenest perception, in the midst of ignorance, inappreciation and Philistinism of the claims of the profession on its prominent and representative members, to the best fruits of modesty, disinterestedness, fraternity and public spirit.

A. J. BLOOR.

NOTES & CLIPPINGS

THE LATERAN'S NEW APSE.—The new apse of the Lateran Basilica was inaugurated yesterday with much pomp. But for the fiction of his imprisonment the ceremony would have been performed by Leo XIII in person, for the Pope as such is Bishop of this basilica, which is proclaimed by an inscription in the portico to be the mother and head of all the churches of Rome and of the world. As it is, the Pope delegated his duties to Cardinal Monaco la Valletta, who celebrated the pontifical mass at the high altar. An excellent choir rendered the music, composed expressly for the occasion by Signor Capocci. The new apse, which is a massive and gorgeous piece of architecture, extends 67 feet beyond the old one. The entrance to it is formed by an arch decorated with mosaics supported by two columns. The principal achievement in the erection of the new apse has been the removal to it of the quaint thirteenth century mosaics which decorated the old one. This difficult task has been accomplished most successfully. The execution of the whole work has taken ten years. Large crowds of people of every condition and political party thronged the breezy aisles of the vast basilica to enjoy this ecclesiastical and artistic festa. The absence of the English tourist was conspicuous, but not strange, in view of the severe heat which has now set in.— *London Daily News.*

WHEN TO CUT TIMBER. — Many years ago two fences on a certain farm were made of common basswood rails, one of them with rails cut in winter and the other from trees felled at midsummer and at once split into rails. The former rotted more or less after some years, while the latter, or summer-cut rails, become hard like horn, and far outlasted those cut in winter. What was the reason of this difference? Simply this: The rails cut in winter were long in drying through the remaining months of winter and through spring; the sap partly fermented or soured and injured the texture of the wood, and unfitted it for lasting many years. The summer-cut rails were placed where they seasoned rapidly, and they became hard and horn-like. There are various theories about cutting timber when the "sap is up," and the "sap down," in connection with the proper time, but they are mostly errors. It is true there is less sap in a tree after it has been growing rapidly, the leaves evaporating in some degree the water in the sap-vessels, and the wood is consequently dryer than in spring before there is any outlet for the surcharged vessels through the leaves. But this is not the reason the summer-cut timber is most durable; it is simply from the rapid drying. Owners, therefore, who have timber to cut, may obtain a supply of more durable quality by cutting down and cutting up now, instead of next winter.— *St. Paul Pioneer Press.*

STRUCTURES ON COMPRESSIBLE FOUNDATIONS.— The subsoil at Chicago, U. S., is wet clay, and yielding to an extent which has caused serious difficulties in many of the heavier buildings by the unequal settlement. One of the most prominent examples is that of the United States Government building, which was built upon a bed of concrete three feet in thickness; the inequality of the pressure upon the foundations has caused an uneven subsidence, and many undesirable consequences have taken place. The concrete foundation has become broken, and cracks in various portions of the masonry, even to distortion of arches, and in two instances stones are reported to have dropped from the decorative work (on April 21) to the jeopardy of persons on the sidewalks around the building. As an example of what can be accomplished by the exercise of engineering skill under similar limiting conditions, the Home Insurance Company's building, in the same city is a fire-proof structure of great weight, being 160 feet in height, and constructed of masonry and iron. The foundation consists of independent piers built of alternate courses of dimension-stone and rubble, and the area of the bottom carefully proportioned to a surface of a square foot to each two tons of load to be supported by the pier. In this manner each basement pier and each vertical line of columns rested upon an independent foundation which was loaded to a uniform intensity per square foot. The beams and girders were very securely anchored together at walls and at intersections, and strips of band iron built into the masonry over arches and other places where reinforcement might be desirable. The whole building has subsided 2¼ inches, but owing to the care in placing loads of uniform intensity of stress upon the foundation, the maximum inequality in settlement has been only 11-16 inches. In our day and generation the wise men are not limited to those who build their houses upon a rock, but must include those who make the sand as stable in its resistence as a rock. The original peninsula comprising the city of Boston, U. S., has been distorted into some other geographical form, and more than double in area by filling over the harbor and estuaries by about 16 feet of gravel over the clay and mud forming the bottom. The large buildings constructed upon this "made land" have received the benefit of skilled engineers in regard to the distribution of the loads upon the piling which support the stone foundations, and bid fair to remain permanent

without any distortion, but many of the elegant private residences on the Back Bay district of the city, being erected under the sole direction of architects who did not avail themselves of the work of engineers familiar with that special branch, have settled irregularly, and many fine buildings are marred by cracks in walls and ceilings. This criticism does not apply in so great a measure to many of the later buildings where more judicious measures have been introduced to provide for uniform settling. The architects are not alone at fault here, for the abutment piers of a highway bridge over a railway on this district were moved laterally, foundations and all, some twelve years ago by the earth pressure caused by the approaches.—*Engineering.*

Barometric Wells.— Mr. J. S. Harding writes to *Symon's Meteorological Magazine* calling attention to the use which has been made in Switzerland of old wells for storm-warning purposes. He quotes from a recent monthly bulletin of the meteorological observatory of the Royal Institute of Riposto that in the village of Meyrin (Canton of Geneva), some disused wells have been hermetically sealed to serve as barometers to the people. An orifice of about an inch in diameter is made in the cover of the well, by which the internal air is put in communication with the external. When the air pressure outside diminishes upon the approach of a storm the air in the well escapes and blows a whistle in connection with the orifice, and in this way notice of a storm's approach is given to the inhabitants. If, on the contrary, the pressure increases, a different sound is produced by the entry of the air into the well, and the probability of fine weather is announced. The idea is a very good one for villages in which old disused wells can be had for this purpose. The indications afforded by the sound of the whistle might not in all cases be correct, and in some might be misleading, but in many cases they might prove valuable warnings. In our Western districts subject to tornadoes abandoned wells could be put to no better use than to admonish the people of these fatal storms.— *New York Herald.*

Mr. Ruskin on Church-building Debts.— The following is a copy of a letter received from Mr. Ruskin in reply to a circular asking him to subscribe to pay off the debt upon Duke-Street chapel, Richmond, S. W.:

Brantwood, Coniston, Lancashire, May 19, 1886.

Sir,—I am scornfully amused at your appeal to me, of all the people in the world the precisely least likely to give you a farthing! My first word to all men and boys who care to hear me is "Don't get into debt. Starve and go to heaven — but don't borrow. Try first begging — I don't mind, if it's really needful — stealing! But don't buy things you can't pay for!" And of all manner of debtors pious people building churches they can't pay for are the most detestable nonsense to me. Can't you preach and pray behind the hedges — or in a sand-pit — or a coal-hole — first? And of all manner of churches, idiotically built iron churches are the damnablest to me. And of all the sects of believers in any ruling spirit — Hindoos, Turks, feather idolators and mumbo-jumbo log-and-fire worshippers — who want churches your modern English evangelical sect is the most absurd and entirely unendurable to me! All which they might very easily have found out from my books — any other sort of sect would! — before bothering me to write to them. Ever, nevertheless, and in all this saying, your faithful servant,

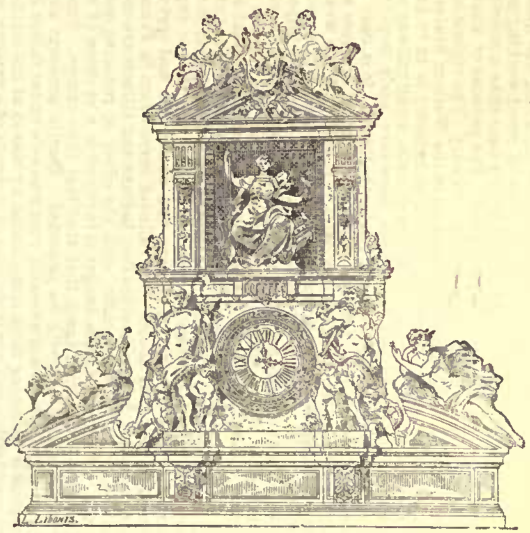
John Ruskin.

Decay of Westminster Abbey.— In the early part of the last century parliament voted large sums toward the repair and completion of the abbey, and it was not until more than 500 years after its foundation that the building was finished by the completion of the two western towers in 1741. Again, from 1809 to 1821, sums amounting in all to £40,000 were expended by parliament on Henry VII's chapel. In point of fact the capitular revenues were never, even in pre-Reformation times, equal to the maintenance of so vast and costly a building; the church was always too large and magnificent for a mere monastery, and was maintained, at times very inadequately, by the bounty of successive sovereigns. From 1830 onward, however, the abbey estates became more lucrative, owing to the increase in value of the property held by the chapter in the northwestern suburbs of London, and for a time the chapter was comparatively rich. The necessity for a large and continuous expenditure on the maintenance and restoration of the external fabric had not, however, at that time been perceived; and when, in consequence of a series of acts passed between 1840 and 1868, the property of the abbey was transferred to the ecclesiastical commissioners and the revenues of the dean and chapter were commuted for a fixed sum, no sufficient provision was made for the cost of maintaining the fabric. The commutation scheme took full effect in 1869, when the late Dean Stanley was dean, and it provided for the annual payment of a certain sum of money to the dean and chapter, and for reconveyance to them of certain estates partly agricultural and partly situated in London. The revenue of the agricultural estates has not, however, proved as great as was anticipated, and altogether the arrangement made was one by which, as in other cases, the ecclesiastical commissioners seem to have profited at the expense of the dean and chapter. However this may be, it was certainly not foreseen at the time that the repairs and restorations necessary to preserve the abbey from ruinous decay would very shortly entail the expenditure of a sum estimated at from £60,000 to £80,000. In 1869 Sir Gilbert Scott had examined the abbey and had reassured the dean and chapter as to the general soundness of its condition. But some years afterward a fresh examination was made by Mr. Pearson, the well-known architect, who reported in March, 1882, that a process of decomposition was going on in the external fabric of the building, which, if not speedily arrested, must result in its ruin. From the time when this alarming report was received the dean and chapter have done their best with the limited funds at their disposal, and some of the most decayed portions of the fabric have been repaired; but the bulk of the work still remains to be done, and there are no funds to carry it on or even to meet the large deficit already incurred. We are satisfied that these facts only need to be generally known in order to induce parliament to take the steps which was necessary to preserve from imminent ruin a building so dear to the nation as Westminster Abbey.— *London Times.*

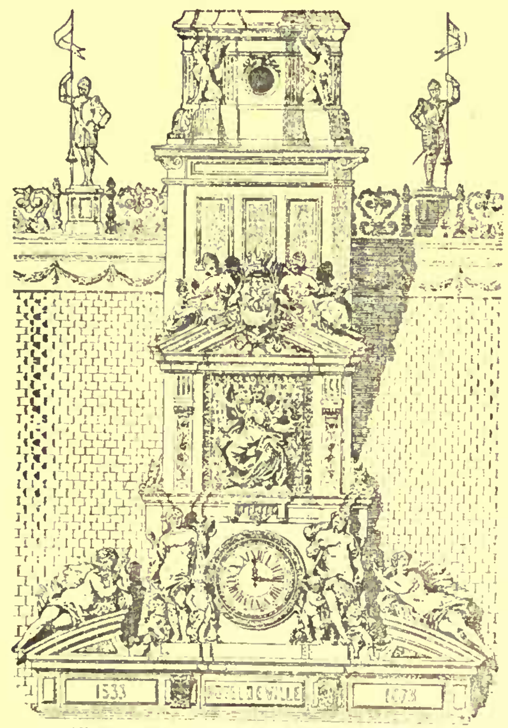
The Royal Palace at Madrid.— The royal palace of Madrid is one of the most colossal and one of the most magnificent royal residences in the world. The site which it occupies is said to be that of the original outpost Alcazar of the Moors, where Enrique IV resided. On the destruction of this by fire on Christmas eve, 1734, Philip V set on foot the construction of a residence which he intended to make into a rival of Versailles. The first design, by Felipe de Jubara, a Silician, was even of more ambitious dimensions than that actually carried out afterward by another architect, Giovanni Sacchetti, of Turin. This plan, though smaller and less costly than the original one, embraced the formation of a block of buildings 470 feet square and 100 feet in height, though the wings of the stupendous edifice have never been completed. So vast, indeed, are its dimensions, so noble its architectural design, and so splendid its internal decoration, that when Napoleon the Great paid a visit to Madrid to see his brother Joseph, whom he had made mock king of Spain, the grandeur and the splendor of the Palacia Real fairly took away the breath of the cold-blooded and cynical conqueror and art critic, who had sneeringly remarked of the cathedral of Strasbourg that it ought to be placed under a glass shade, and of the Duomo at Milan that its wondrous marble tracery would serve very well as a pattern for the laced border of a lady's pocket-handkerchief. On ascending the grand staircase he halted, turned to King Joseph and said: "Monsieur mon frère, you are better lodged than I am." — *London Telegraph.*

TRADE SURVEYS

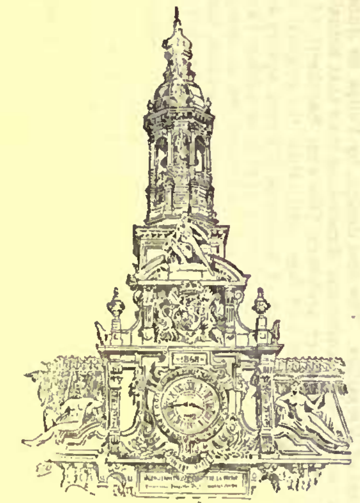
The autumnal season, if it may be so termed already, has not for years opened with as favorable prospects as this one. The various commercial agencies make very encouraging reports, substantially agreeing in a twenty per cent reduction in the number of failures involving a capital of over $5,000, and a decrease of twenty-five to thirty-three per cent in the liabilities. These favorable prospects are not altogether reliable. It was the apprehensions more or less generally entertained early in the season that preserved a conservative policy among producing interests. The strike outbreak helped. Both these influences permitted stocks to be absorbed, and prevented, or rather checked, a glutting of the markets. If manufacturers and house, shop and railroad builders are going to take it for granted that our country is hungry and that the channels of trade are comparatively empty, they will not be very long in overcoming the good but somewhat accidental efforts produced by the causes named during the first six months. The impetus given by the abundance of capital is almost a permanent one. House building is going on actively. The June returns of the Real Estate Exchange of New York shows a larger business in buying of real estate and in new construction than during June of last year which had not been damaged by strike agitations. Plans were filed for 495 new buildings costing $6,732,755, against 320 for June last year, costing $5,151,425. For six months the transfer shows an excess of 1,500 in number and $41,000,000 in value. The outlay this year, in course, foots up $37,500,000, and the estimated outlay for the entire current year is $75,000,000 against $44,000,000 last year. Brooklyn shows a falling off from 2,030 projected buildings during the first half of last year, costing $10,567,417, to 1,878 enterprises this year, to cost, when completed, $9,267,417. The Philadelphia statistics for like periods are 1,796 against 1,964, showing a favorable increase this year over last. Throughout Pennsylvania, New Jersey and New York the extension of building operations is general. The demand for lumber, brick, stone, lath, cement, slate, roofing-material, to say nothing of house furnishings, is such as to lead the most doubtful to the conclusion that the building activity is deep and widespread. There is nothing in the labor field to note. Railroad strikes are over, and a District Court of the United States at Indianapolis proposes to lend its influence to put an end to them. With the Locomotive Brotherhood in the cab and the Knights on the track, and the United States Court in the background, we may expect some freedom and relief. The strike of a thousand or so mill men at Philadelphia has no special significance. The iron trade generally is quiet but a heavy demand is probable for all kinds of material. The coal producers are feeling a depression. The Vessel Owners' Association on the coastwise carrying trade are barely able to sustain rates. The lumber demand is heavy and continuous in all Eastern, Western, and Southern markets, and fair prices are realized. Yellow pine is growing in demand at certain points. White pine is active in New England markets along with spruce, but is dull at New York and Philadelphia. The hardwoods are not plenty and high prices rule for good stuff. Saw-mill interests are encouraged to extend plants, and planing-mill interests are growing along the lines of railroads contiguous to lumber fields. The makers of wood-working machinery are able to give more encouraging news at this time than a month or two ago. The fall outlook is said to be very good. The promise of abundant crops is not lost on the agricultural implement industry. The reports lately received from a few of the larger establishments in the Western States, warrant the conclusion that this prosperous branch of industry is to be favored with a further increase of orders. Files, small tools, small railway material, such as spikes, nails, nuts and bolts have been very lately largely inquired for by railroad builders and car and engine builders. It is easy to write good news at any time, but especially when no argument or guess work is necessary to assure ourselves that the news is reliable. From west of the Mississippi comes the announcements of the inauguration of extensive railroad building. So, also, from the extreme Northwest an impulse has been given to manufacturing and mining enterprises. New York capital has gone thither under attractive inducements. In fact, despite the Chinese-labor cry, the Pacific coast is a prosperous region and capital and enterprise are drifting in that direction rapidly. Prices in all branches of manufacturing are remarkably uniform. Locomotive work was never cheaper. Lumber prices have been lower, but a keen competition fails to depress them at present. Coal is lower than ever and new mines and regions are being opened to save long hauls. The railroad corporation in Pennsylvania and manufacturing corporations in Ohio, Indiana and Illinois are competing with each other for the coal traffic, with the effect of reducing coal to the consumer. Whatever future danger is involved in a revision of the tariff, the industries breath free again that they feel their escape. Steel rails at the proposed reduction could be imported. Textile products also could land more freely. Wool will probably continue safe under future attacks. The question is becoming more complicated by reason of the mixing up of political predilection and newly-developed interests of a personal nature. Much industrial capital finds safe and profitable employment in reproductive channels in the old hot-beds of free trade.



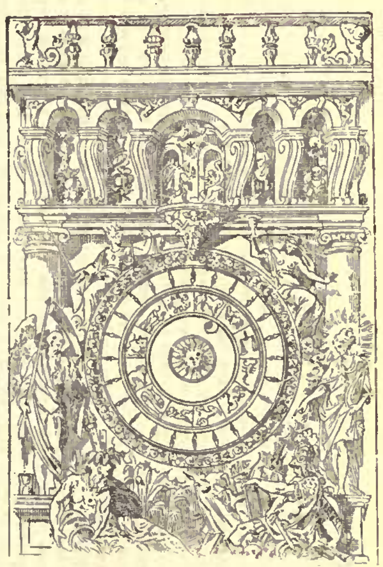
Clock, Hôtel de Ville, Paris.



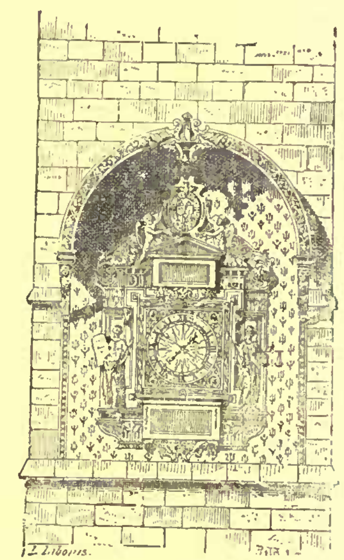
PEDIMENT AND DIAL OF THE NEW HOTEL DE VILLE PARIS



The Belfry : Hotel-de-Ville : Valenciennes France. designed by M. Dupont.



Clock at Bologna, designed by Nicolo dell' Abate.



Clock on the Palais de Justice, Paris.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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WHAT would probably have formed a leading case on the interesting question of the proper commission to charge for unexecuted work has unfortunately been compromised before a jury. Not only the circumstances are interesting and comprehensive, but the standing of all parties concerned and the amount of the claim make the case an important one. The case is that of Robert Kerr, Professor of Architecture at Kings College *vs.* Lieutenant-Colonel Miles Sandys, and was heard before the well-known Baron Huddleston in the Queen's Bench Division. A professional man hardly ever appears before a judge and jury without prejudicing his case, either by the apparent unreasonableness of his claim, or by his inability to answer simple business questions in a comprehensible and practical manner. In the present instance, the case was complicated by the presentation of three separate accounts, varying between sixty-three hundred and eighty-four hundred dollars, each confessedly computed on different total amounts, and a different distribution of percentages adopted for each, and we do not wonder at the exhibition of some little exasperation on the judge's part when an architect, giving evidence for the plaintiff, declared that the charge was a proper and fair charge. This led the judge to ask: "To which do you refer as fair?" "I do not know." "Is the first bill for £1269 fair?" "Yes." "Then is the second bill for £1694 fairer, and the third claim for £1541 fairest?" "I do not know which is the fairest bill. A charge for alterations to plans depends on the trouble occasioned. A charge of two and one-half per cent for plans and alterations is a maximum." His Lordship: "A maximum with architects is, I expect, as much as you can get." From such evidence as this we do not think Professor Kerr could expect much help, and we feel he was very lucky in having his case heard before a jury who, just at this point, announced that they considered the £950 that Colonel Sandys had paid into court at the opening of the case was all that the plaintiff could hope to recover.

THE history of the case is this: In 1882 Colonel Sandys asked Professor Kerr to examine Graythwaite Hall and report what alterations were advisable. For this report the architect was to receive "whatever the other pleased to pay him." The report being apparently unfavorable, the architect was then instructed to prepare designs for a new house, but no limit of cost was named until the cost of this first design had been arrived at by the process of "cubing"; £20,000 was then named as the sum the client was willing to spend on the house, stable and out-buildings. During the next year another architect suggested certain alterations, and Professor Kerr embodied them in a new design, and subsequently repeated this operation; indeed, he claims to have entirely recast the design five times before the client, in 1884, professed himself perfectly satisfied, and asked for such a bill of quantities as should, with the drawings and specifications, enable his successor — for Colonel Sandys by this time had abandoned the idea of building himself — to carry out the design which had met the approval of his ancestor. At this point the architect's bill was asked for, and the client was not unnaturally startled at the charge for "mere work on paper"; still, as he had some inkling of professional custom, he was ready to pay two-and-one-half per cent on the sum named by him as the limit. The architect, however, considering the unusual amount of work, and the length of time over which it had extended, thought a charge of two-and-one-half per cent for drawings, one per cent for the report, and one-half of one per cent for the quantities computed on the estimated cost of some £28,000 was only reasonable, and if he had only stuck to this, the case might have been fully heard. Unfortunately, he shifted his ground, and sent in subsequently two different accounts, computed in ways each of which he asserted to be in accordance with professional usage, and yet, when analyzed, a discrepancy of £351 was shown to exist between the charges for quantities in two of the accounts. This juggling with figures was very maladroit, to say the least, and if the jury had expressed the opinion that Colonel Sandys should pay only two-and-one-half per cent on £20,000, we think no one could have upbraided them. As to the propriety of the charge made for the quantities, it appeared that while two per cent is the usual charge for complete and accurate quantities, Professor Kerr, as only approximate quantities were needed, bargained with a surveyor to take them out at five shillings per hour, himself and his son assisting in the task. The surveyor testified that he did about half the work and was paid forty pounds; that is, he would have done the entire work for about one hundred pounds. Yet we find that the least charge made against Colonel Sandys for quantities was £215, while the largest charge was £566, which strikes us as rather a long profit.

TO our mind, archæological research is of a somewhat doubtful practical value, though many of the results so laboriously attained are unquestionably interesting, and a few of them useful. The investigations of Schliemann, Marriette, Maspero, Brugsch, Leyard, Pettrie, and a host of others, have done much to confirm or disprove history, so far as it rests on imperfectly-recorded legends, and all unite in discovering testimony which, to a certain extent, discredits Bible history, so far at least as dates are concerned. We do not recall just how far back the researches of these Eastern explorers has placed the formation and peopling of the world, but we question if any of them have succeeded in moving the date of the beginning of mundane affairs quite so far back as has Dr. Le Plongeon, who, with his wife — even a more helpful spouse than the devoted Mrs. Schliemann — disinterred, not long ago, the heart, still transfixed with the flint spear-head that killed him, of Koh, king of the Mayas more than eleven thousand years ago, the Mayas being at that time a comparatively civilized race. The history of Koh is interesting, and the events which followed his death Dr. Le Plongeon believes gave rise to the myth of the temptation of Eve by the serpent, the serpent being the totem, as it were, of the Mayas. It was the law of the country that to preserve the purity of the royal descent the youngest son of the ruler should marry his oldest daughter. Koh was the youngest son, and dutifully married his sister Moo, but, unfortunately, another brother, Aac, was in love with this sister, and, urged by jealous revenge, ran his spear through his brother's heart. Then, having smoothed the path of courtship in this summary way, he sought his sister's hand after the manner of the country, by sending messengers with gifts of fruit and flowers, the acceptance of which by Moo would signify the acceptance of his suit. But Moo seems, on the testimony of a mural painting, to have remained faithful to her young brother-husband, for she is there shown rejecting the offered fruits, while a serpent in a tree gazes thoughtfully at a macaw (the symbol of Moo), to observe whether she will yield to the temptation. The woman, the fruit, the serpent and the temptation being thus present, Dr. Le Plongeon professes to find in them the originals of the myth of the Temptation, which makes its appearance in the legendary sacred history of other nations.

DR. LE PLONGEON takes a very pronounced and advanced stand as regards the discoveries he has made, and he certainly has found both direct evidence and credible analogies to give him no infirm support in his theory that the

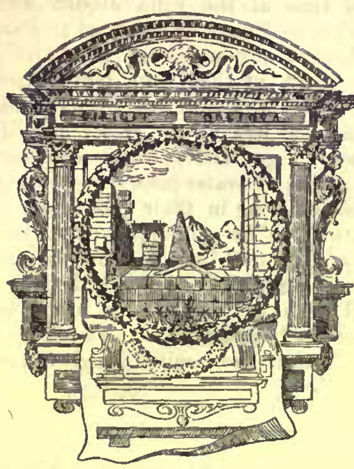
Mayas are not only the oldest people still inhabiting the earth, but that they are the parent stock, from which the nations of the East are descended. In short, that instead of being a colony which had wandered across the seas or down the coast from Alaska, as some theorists maintain, the Maya race sent out the colonies which settled the other nations, which we have so long been taught to believe are the oldest. To be able to accept his conclusions, one must read the published accounts of his explorations and follow his arguments as he translates hieroglyphic tablets and explains their analogies with the similar records on Egyptian monuments; must attend closely as he interprets the meaning of the mural paintings and points out their similarity with the historical legends of other countries; must try to understand his philological deductions which make it appear that the Maya speech, a live language yet, is coeval with, perhaps anterior to, the Sanscrit, and above all must be capable of understanding the arguments he bases on the religious customs, the structures in or on which the rites were celebrated, and the monuments, sculptured and architectural, that offer evidence to him who can understand them. The claim thus made is certainly a wide one, and whether it can be supported or not can only be determined by other investigations. At any rate, the Central American territory affords a richer field for the adventurous explorer than that which is worked in the old world — we will still call it so. Dr. Schliemann and his compeers are to a certain extent assisted by the fairly-definite information contained in the works of early writers, but we question whether they would have achieved in Yucatan the same results that Dr. Le Plongeon has arrived at: it seems as if the possession of instinct and not learning were the first requisite for success there. It is a pity that Mr. Lorrillard's example in sending M. Charnay on an exploring expedition in Central America has not been followed by other private individuals or newspapers, if Government itself is indisposed to act.

PEOPLE still talk — we trust they will long talk — of Mr. Richardson and his works and the great good he did, not only to the architecture of the country but to the members of the profession as they stand before the public by showing to the world, in language easily understood, that an architect is, or may be, a man who can use building materials as they cannot be used except by an artist. The latest remarks on the man and his career that have come under our eye are those of such widely different men as Henry Irving, the actor, and Charles Francis Adams, Jr. Mr. Adams, at the Harvard Commencement, suggested that as the Memorial Hall was, or ought to be, the Walhalla of the University, and that a Harvard man or his friends could desire no more grateful memorial than a place on its walls, it would be a fit recognition of the services which Mr. Richardson had done to the University and the country at large, to hang on the walls the portrait of him which Mr. Herkomer had recently painted. We do not know how the family would feel about parting with the portrait, but the idea strikes us as a good one for the rest of the world, and in the vast hall the portrait, which is at once strong and sketchy in treatment, might develop merits which those who have seen it in smaller rooms have been disposed to deny it. We understand that it is Mr. Herkomer's desire to make an etching after the portrait—and he promises to make it the best he has ever made.

M. CHARLES GARNIER had the good fortune once on a time to build the Nouvel Opèra at Paris, and was at once hailed a great architect, and though his subsequent work has, so far as we know it, not been just what one expects from a great architect, this may have been because proper opportunities were lacking, not genius. Having always suspected that M. Garnier was a bit of a *poseur*, we turned with much interest to the response he made when recently the Royal Gold Medal for Architecture was bestowed on him, nominally by the Queen, actually by the President and Council of the Royal Institute of British Architects. The occasion was one when, from the lips of a French architect of high rank addressing a large body of English architects, one might expect to hear something a little more serious than, for instance, the frothy nothings which constitute an after-dinner speech; but the opportunity seems not to have been perceived by M. Garnier. whose remarks were, when not mere *banalités* — the English language is weak by lack of this most effective word — delightfully egotistical. In rehearsing his early career, M. Garnier recounted, among other things, that when, after having passed the allotted time at the Villa Medici which falls to the winners of the Prix de Rome, he returned to Paris, he found himself in straightened circumstances, and with no chance of obtaining work. Just at that time Her Majesty Queen Victoria chanced to visit Paris, and the Prefect, desiring to do her honor, gave a great hall at the Hôtel de Ville, and to prevent the affair becoming a merely evanescent memory presented her with an album of water-colors, representing the various halls of the great building in their gala array. It was the fortune of M. Garnier to be commissioned to make two of these water-colors, and of this little incident he made the most, saying that he considered the queen his first client, and that to her he owed all his future success. It seems as if some of his English hearers must have wondered on hearing this if he had ever styled himself, after the familiar English mode, "water-colorist to the queen."

"ONE'S own children are always the prettiest," and if a man's name happens casually to appear in print he is pretty sure to think that this phenomenon makes as much impression on the rest of the world as it makes on himself; but if the man himself, his words or his actions are the subject of serious discussion in the public prints there is a real reason for his feeling that the eyes of the world are turned upon him. If this is a reasonable deduction in the case of an individual it seems as though it would be equally just in the case of a class or profession. The criticism, whether favorable or unfavorable, becomes only more worthy of respect and attention when it is made by a competent critic, a member of the same profession, or a body of fellow professionals. Dr. Freeman was, perhaps, the first critic who, in our own day, that is, since the latest development of our architecture began, discovered that the work of American architects was worthy of respectful consideration, and in the last few years many another has had occasion to say encouraging words of our work, and in many cases to hold it up for the admiration and emulation of architects in other parts of the world. Until lately our work has been so much influenced by English fashions that it is not strange that English architects have not been impressed with the slight external differences which climatic requirements or national habits have led us to make in *motifs* which were unquestionably imported from England by means of the English architectural journals. The English travelling architect has had his attention drawn rather to our modes of construction, and he has, of late, been very free to acknowledge that in the field of constructive science we have developed many excellent methods unknown to him. On the other hand, the French architect, though a rare visitor in his proper person, finds in our architecture as it is delineated in our professional journals much in the matter of design and plan which is as worthy of consideration as the architecture of other countries, and though we may credit something to the French habit of saying pleasant things in a delightful way, still it means a good deal when the last issue of the *Moniteur des Architectes* says, speaking of the rational way in which we treat our porches (as shown by certain sketches which it reproduces from our own pages), "See how much more logical the Americans are and how happily this feature is understood by them; this is true art in which the architect can take pride because it denotes much maturity of perception [*esprit*] and great independence of tradition." And apropos of tradition, M. César Daly says, in a late issue of the *Revue Générale de l'Architecture*, "For the Americans the traditions of Europe are like an orange which he has just sucked dry and the skin of which he is about to throw away." *La Semaine des Constructeurs*, also, in a late issue, reproduces certain illustrations from our own and the pages of the *Sanitary Engineer*. From all this it appears that American architecture is attracting as much attention abroad as it deserves. It is to be observed and remembered, however, that praise is bestowed on our work only so far as it is the manifestation of real architectural art, logical, well reasoned, the outgrowth of constructive necessities of plans which themselves are determined by national or climatic demands and the peculiarities of the building material used. Discriminating praise will do us more good than avalanches of derision launched at the eccentricities, absurdities and extravagances of our venacular architecture.

AMERICAN ARCHITECT COMPETITION FOR HOUSE COSTING $5,000. — I.



CUL-DE-LAMPE DESIGNED BY SÉBASTIEN LE CLERC.

In awarding the prizes the Committee has considered that under the prescribed conditions the plan was of more than usual importance, and that whereas there are quite a number of plans which would make very acceptable country houses, there are but few which fulfil all the requirements. These requirements state "the children, the novelist and the outlook are the only special elements to be accounted for." The children, by a planning of nurseries or a room or rooms which can be used for nurseries, and a convenient bath-room. The outlook, by so disposing the principal rooms that the view can be obtained and as little sunlight as possible sacrificed. The novelist, by complete isolation of some sort or another. All three of these points have been much disregarded, most of the competitors apparently assuming that children are locked into their rooms for the night and do not need to have their rooms connect with that of their parent, that rooms facing the northeast need no sunlight and that the nearer the novelist is to the front door and the casual visitor the better. For this reason the plans isolating the novelist are placed first, other things being equal. This has been done in several ways, either by placing his study in the third story, as "*Birdseye*" has it, by shutting it off from the remainder of the house, as done by "*Gosh*," or by placing it on the staircase landing, as "*Charles Dickens*" has placed it, any one of which expedients is equally good according to the preference of the novelist. In regard to the limit of cost, $5,000, it seems at first glance that but few of the designs come within it, and those few have been credited with the possibility and placed accordingly; but what apparently cannot be done in some locations and under some conditions can be done elsewhere under other conditions — so that, apart from the general impression that the house needs to be cut down to as small a surface area as possible, apparent expense is ignored. There are one or two points that could be noticed, however. A basement kitchen always requires one more servant than would otherwise be needed and is consequently to be avoided in a house for people of small means. An excellent method of saving surface-area in the halls (where, by the way, there is most waste room on many of the plans), is to make back and front stairs meet on a common landing half-way up to second story and then continue in one run. This has been done only by "*Scotch Thistle*." Lastly, very few of the competitors have remembered that the house is upon a "*barren hillside*," and but little skill is shown in placing the house upon the slope.

"*Charles Dickens*." — Plan good, except that nurseries have northeast exposure and there is no west light in house. House well placed for view, but needs terrace on northeast; it has sufficient morning sun. Novelist is isolated upon level of staircase landing in a study which has no view but which has access to the library and the possibility of escape to second story. Details are good. Elevation is very good. Perspective has the fault of two equal gables unseparated. Wherever two equal gables come together at base without an expanse of separating roof the effect is not good. If they are above the same wall and on the same plane, they need a straight piece of cornice of greater or less length between them. If they are at right angles to each other, as in the present case, one of them should be subordinated to the other and made a dormer, the result being that the design will then have one simple roof with subordinate dormers and not two roofs struggling for supremacy. The west gable could probably best be made into a dormer. Rendering though good has followed too closely the faults and not the virtues of that of Mr. T. Raffles Davison, is too uncertain and sketchy all over. Good architectural rendering, no matter how sketchy it may be in parts that do not require too much attention, has at least a clearness and directness of expression in all the important features of the design, and does not leave gaps in ridges, nor leave windows without sills, so that the drawing seems like an imprint from a worn-out and well-nigh worthless etching plate. Could probably be built for the money.

"*Normandie*." — Plan has the serious objection that the study is not isolated; the novelist cannot escape visitors once admitted into the hall. The placing of house and the reasons given for it are good, and show just the sort of study that the problem demanded. Details are simple and excellent. The exterior is open to objections which would have more or less weight with different critics, but which are the usual faults of most simple so-called Queen Anne houses — that is, of most houses where the purpose is to make the interior of the utmost convenience and comfort, and the exterior express the interior in the simplest way, with the sole assistance of good outlines, agreeable surfaces of material, and with good shadows and color. It goes without saying that such a house, which is in most cases incapable of having classical symmetry, owes its entire quality (apart from color) to its relative proportions of parts, and to its light and shade as given by its mass, eaves, and stories and windows. This granted, "*Normandie's*" design is open to the following objections: 1. Too much wall-surface for the roof. 2. Too small a triangle over staircase window for walls below. 3. Too little projection to eaves for amount of wall-space below. 4. A single corner tower, not isolated on the one hand or supported on the other — a study of a photograph of the "Farm of Tompes," Bure-en-Bray, near Neuchatel, will show by contrast both methods of making a corner tower compose well with a building. A corner tower is a difficult thing to handle in wood, and is very difficult to balance if it forms the termination of the mass of the building, excepting in conjunction with another similar tower. Rendering is excellent throughout. House could probably be built for the money.

"*Scotch Thistle*." — The plan is, if anything, better than that of "*Charles Dickens*." The kitchen is shut off from rest of house and well placed for servant, conveniently near front door. The staircases are brought together on the landing. The study is well isolated in third story. The house is well placed for views and sun and sits the slope well. Perhaps it would have been better to do without the library and throw it into the hall. The details are good. The elevation is good, but the rendering of the perspective does not begin to do the house justice. The point of view taken shows it at its worst, the long and short lines of the rakes of the gable following each other like two siphons, and the design seems to want more projection of rakes and eaves to overcome a certain bareness of effect common to wooden houses. There is an exactly similar fault in roofing this house to the one that "*Charles Dickens*" has made. Two equally important gables are struggling for supremacy. If the roof running north and south were made the main roof with eaves at equal height on both sides and the study gable changed into a large dormer, the house would be much improved. The rendering is vigorous but dry and the touch is not assured. The rendering of plans seems hasty. The house could be built for the money.

"*Birdseye*." — Plan is good. Novelist well isolated. Bedrooms conveniently arranged for children. House well placed for view and sun and sits the slope of hill well. Lighting of second-story hall ingenious. No constructive details; other details good. The balcony to study is somewhat of a snow-trap. The exterior design has a serious fault: the perpendicular treatment of living-room bay terminating in novelist's room is entirely out of keeping with the long, low, horizontal line of a gambrel-roofed house. It would be better in the middle of the long side of such a house than at the end, but would be difficult to make harmonize under any circumstances. It would have been better to have made the house frankly a gambrel-roofed house with the novelist's room on the northeast side where the flat roof is shown on plan, and to have lighted the hall from above. Rendering of house is good. In rendering landscape too many short lines are used.

T. T. R. & B. — Plan has same objections to it as that by "*Normandie*." It is compact and simple, and has bedrooms well arranged, and good exposure to the sun. Details are excellent, except that a moulding or two might be acceptable in the cornices; but when we come to examine the exterior, the difficulties thicken. The general scheme of the perspective is excellent — apparently simple and effective. Corner tower well supported by gable, of good proportion and well flanked by balcony, with its heavy shadows, which serve to define the horizontal treatment of the house in spite of the perpendicular tendency of the tower; but the more the design is studied the more faults are seen. Apart from the manifestly weak curve of the tower-roof, and the very bad termination of the peak of the gable, what is to happen to the roof over parents' bedroom? According to elevation and perspective, the main ridge swings forward 4′ 6″, and is 10′ 0″ from line of southeast wall. The eaves over parents' room are on a line with those of balcony, 19′ 0″ below the ridge, making a pitch of 10′ 0″ base to 19′ 0″ high to gable, a frightful pitch. The space over southeast children's bedroom has to be roofed in some way, either by gable or dormer running at an angle into the 14′ x 17′ pitch on one side, and the 10′ x 19′ on the other, and the result must be one of the worst hotch-potch of roof-lines imaginable. The warped ridge is bad, in the first place, and is a mere affectation. It is a very awkward plan to roof at best, but the old rule of roofing the largest parallelogram first, and letting other roofs be subordinate, could be applied and simplify matters. The large rectangle of plan could be roofed with gable, or hip ends, as preferred, the small rectangle of the parents' room made a subordinate roof, butting into the other. The south corner of children's bedroom and dining-room cut off parallel with main line of house, the rooms made symmetrical at both ends, and the subordinate roof brought into main roof on south with a sweep. This, of course, is merely knocking the roof into shape. The better method is to straighten out the plan. House could probably be built for the money. Rendering excellent.

Henry Van Brunt,
C. H. Walker.

Making Nails for Punishment. — To make nails was one of the sentences imposed in Massachusetts 100 years ago as a punishment for crime, and 12 nails a day was accepted as a day's work. — *Iron Age.*

SITTING STATUES.[1] — IV.

"JOHN HARVARD." "LABOR." "THOMAS PAINE." "AULD LANG-SYNE."



"Labor," Post Office, Boston. D. C. French, Sculptor.

MR. FRENCH went through the scheme that he laid out in the "Harvard" easily and happily. If it does not show the most intense study of the more intricate points of the subject, it is free from labored indefiniteness. An excellent and well-determined part of the composition is the chair — large, well-proportioned and in good style. The statue, as a whole, is, in freedom of movement, general composition, and unaffectedness of detail on the right way toward a good work of art. The sculptor has evidently done his best. The statue is worthy of study and it ought to have a good influence.

One would naturally suppose that it would have a good influence in Boston, and that the public would take advantage of its existence to get as good, if not a better statue, whenever the opportunity occurred. But such has not been the fact. Since the erection of the Harvard, statues of two eminent citizens of Boston — Theodore Parker and Abbott Lawrence — have been ordered, the first from a person whose capacity as a sculptor is quite unknown, and the second from a person whose standing in profession is open to dispute. Another important public monument, including a statue, to the memory of General Joseph Warren, is proposed to be executed by a granite company at an estimated cost of twenty-five thousand dollars, and from a design by a person also unknown to those interested in art.

It would seem that the appreciation of public monuments had reached its lowest level when their execution is consigned to the art facilities and employed labor of a granite company, or to the experimental fancies of persons known as unworthy to be trusted with such important matters. The assertion that "sculpture is not a difficult art," which was made by a leading professor of art in a neighboring college, was to many a startling indication of a new phase of art intelligence. The enormous amount of statuary of every conceivable description that has been made in the United States during the past twenty years by granite-cutters, has been regarded by art lovers with anything but satisfaction. It seems, however, that the professor was in accord with the prevailing public feeling that "any one can make a statue," and Boston, the long-acclaimed centre of art sensibility, has confirmed the assertion as completely as the author of this dictum could wish. However lamentable these things may be, they are by no means novel or unexpected. They are really the legitimate result of causes not difficult to trace. One of these causes is found in the indifference shown to the value and existence of the first good statues erected in Boston. One instance of this indifference is illustrated in the history of the marble statue of Washington[2] by Chantrey. It was erected in the State-house, in 1827, in a room fitted up expressly for it by the Association through whose efforts it was procured.



Auld Lang-Syne.

The conditions upon which it was given to the State and accepted by it were that "the hall in which it stands should never be appropriated to any other use, or to the exhibition of any other monument or work of art than the statue of Washington;" and that "it should be seen by the public at all times, with the exception of Sundays and Thanksgiving Days, on which days the State-House was closed, in obedience to an order from the General Court."



Thomas Paine. D. Richards, Sculptor.

Since 1865 this hall has been appropriated for the preservation of the State battle-flags, and the entrance closed with glass. The public are not admitted to the room, and the only way of getting into it is by climbing over a high iron railing and crawling through a door three feet high and twenty-two inches wide. For all art and public purposes the statue does not exist, and its existence was blotted out by the deliberate breaking of a covenant.

The "Bowditch" statue was erected in Mount Auburn cemetery in 1848, and the "Otis" in the chapel of that cemetery about thirty years ago. Every statue erected in Boston since that time is much inferior to these three, and many of them are too wretched to be called statues. The ease with which a good statue can be forgotten in Boston is proved by a communication to one of the city papers not long ago, in which the writer advocated, with much learned zeal, the great debt of gratitude due to the memory of James Otis, and the necessity of erecting a statue to his memory. That a fine one already existed was a fact the author of the article gave no suggestion of knowing. The communication closed with a Latin quotation to the effect that, after all, the very air itself, more lasting than monuments, would preserve Otis's memory.

A still more noticeable instance of the indifference to art in sculpture in Boston is found in the vicissitudes that have befallen "The Falling Gladiator," by the late Dr. William Rimmer. This statue was made in 1861, within a few miles of Boston, under the most incredible circumstances. Its author is the only real art genius who has ever lived on this continent, and the statue far exceeds in merit anything ever done by an American sculptor. For twenty years after it was executed it was tossed about as a curiosity, and finally stowed away in an art institution in New York, wholly forgotten, except by its author. After his death it was hunted up by his family, and now finds a harbor in the Boston Museum of Fine Arts. Several attempts were made, during Dr. Rimmer's life, and after his death, to collect money to put the statue in some more enduring material than plaster, but wholly without success. So far as the effect of "The Gladiator" upon public taste and appreciation is concerned, it might just as well have been buried with its author. The distinction, never very clear, between art in form, and forms or images set up as art, has been fast growing less so, until the time has come when "anybody can make a statue," and the wide-awake granite contractor is the accepted purveyor in one of the greatest expressions of a people's immortality.

The granite pedestal upon which the "Harvard" is placed was designed by Mr. C. H. Walker, a young Boston architect. It is handsome in itself, and composes well with the statue. There are several facts about it that are especially noticeable, and which show that the very difficult subject of the relation between a statue and its pedestal has received careful study from the architect and sculptor. The incongruity that almost always exists between American statues and their pedestals is a serious reflection upon the artistic ability of both

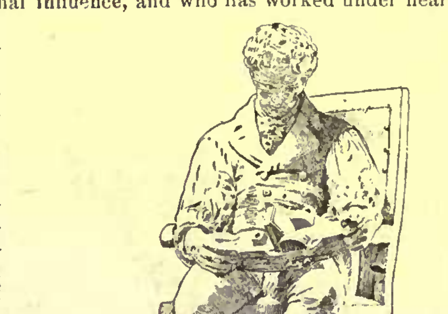
[1] Continued from page 281, No. 546.
[2] See *American Architect* for June 11, 1881.

sculptor and architect. The slight convexity of the sides of the Harvard pedestal was an art necessity, clearly recognized and intelligently met. The line of ornament around the pedestal near the top is another indication of the understanding of an art problem. It makes the needed division between the statue and its support in the right place. The soft, light, pinkish color of the granite is especially agreeable. Nothing can exceed the coldness and the absence of art interest in the vast majority of granite pedestals, except the rigidity of their lines and surfaces, and the hardness of their execution. That a pedestal should and can be a work of art, instead of a pile of repulsive granite, is something yet to be accepted by those who are concerned in their erection.


Statue of Lemartine, Macon, France. Falguiere, Sculptor.

The central figure of one of the colossal groups that decorate the United States Sub-Treasury Building in Boston is called "Labor." It is placed about eighty feet from the pavement. Our illustration is from a photograph taken from the roof of a building opposite. Both of the groups were made by Mr. French, and were illustrated in the *American Architect* of August 29, 1885. We use the "Labor" to further exemplify the freedom of movement that characterizes the "Harvard" — a freedom that is very near to weakness in the "Labor." But this freedom, with a more definite and comprehensive conception of the subject, and a more vigorous bringing together of the body and its members, would have made an imposing composition.

The statuettes of "Thomas Paine" and "Auld Lang-Syne," by David Richards, are included among sitting statues, because they have the qualities of statues in them: qualities which are rare in American sculpture, and which have an unusual interest in this case, from the fact that they are displayed in the works of a sculptor who has never been recognized as deserving a place among the notable sculptors of this country, who has never possessed either social, political or professional influence, and who has worked under nearly all the embarrassments that could possibly surround him. Nor is this all. Popularly and professionally speaking, Mr. Richards would be classed among the dozens of cheap modellers of the country, who call themselves sculptors, and who work most of the time for the enterprising contractor of public monuments; the chief object of their work being to make the largest image for the smallest sum of money.



Robert Fulton, in the Capitol, Washington. Howard Roberts, Sculptor.

We admire the statuette of Thomas Paine for several vital reasons: the fundamental idea of the subject—its thought-receptive attitude — was understood by the sculptor, and a conscientiously artistic effort made to express it. It is the only example of this high style of art conception that we know of in American sculpture; a style having a splendid modern expression in the Lamartine statue, by Falguière.

The sculptor has brought together all the material of his subject — more than was necessary, and some of it cumbersome. At first sight the superabundance of material and the uncertainty of its arrangement is disturbing. But this is soon forgotten, in view of what he has succeeded in accomplishing and suggesting, and the true artistic sense he has displayed in his efforts to make an intelligible and forcible composition. The chief uncertainty of the "Paine" is in the position of the arms. Either the right hand should have rested upon the thigh, or the left arm been engaged in holding the scroll upon which the thought was to be written. In the first case, there would have been a more harmonious ease of body and a more concentrated purpose of mind. In the second, the alertness of both body and mind would have been in unison. In spite of this uncertainty and the meagre chair, strained right leg, heavy table and scroll, the fine idea of the statuette is plainly evident. These faults could have been avoided by more study. They are not those of a barren nature or of over self-confidence. The human feeling of the "Paine" is one of its chief merits, shining out over all its faults, and far outweighing all merit of requirement. If the "Buckingham" had a tithe of this quality it would recommend itself to human interest. It would be better for the "Harvard" also if it were a little more winning in this respect. Sympathy or approachableness is a quality so rare in American statues that it seems like some new thing whenever it appears.

The group of "Auld Lang-Syne," is, like the "Paine," full of merit and not free from faults. It is much more picturesque, better composed, and less dry and precise in its modelling. The figures are replete with character, individual and composite. The types are well chosen, and the sentiment nicely and fully expressed.

Both of these statuettes have the air of statues. As an example of a statue in size that retains the character of a tiny statuette, the "Fulton," by Mr. Howard Roberts, of Philadelphia, is the most extreme of anything we know of anywhere.

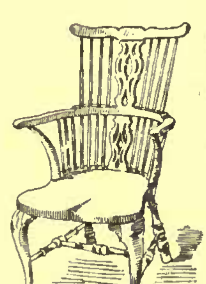
Another great quality of Mr. Richards's work is the predominance of the character of the subject over his own personality or that of his model. He sees his subject generously and fully, from a fine point of view, and works mightily to interpret it. In a future article we shall speak more at length of this sculptor. At present we venture to say that by nature he is more of a sculptor than many of his more fortunate contemporaries, and that if he had had their opportunities he would have distanced them all, even in their individual merits.

T. H. BARTLETT.

[To be continued.]

AN EDITOR'S TRIP ABROAD.[1] — IV.

THE LONDON PICTURE EXHIBITIONS.


A WINDSOR CHAIR. (CABINET MAKER.)

FOR the first time in my life I have seen, within the last two weeks, all the pictures that I cared for. There is no saying how soon I may want to see some more, and I have yet the National Gallery to look at, but with the Royal Academy and the Grosvenor Gallery and the *Salon* for modern pictures, and the Louvre for the older ones, one must be insatiable if he could find any vacancy unfilled in the range of his artistic appetite.

Naturally, the architectural drawings in the Royal Academy appealed first to my attention. The general aspect of the room in which they hung was particularly pleasant. Not only was the mixture of pen-and-ink with colored drawings judiciously made, but the background, formed by paper or decoration of a pale, terra-cotta color, figured in a still lighter shade, extended only a few inches above the upper row of frames, terminating there beneath a wide wooden frieze, painted of a very faint, yellowish-gray color, so that, although the pen-and-ink drawings had just sufficient color behind them to warm them up, there was nowhere enough, even of the unobtrusive terra-cotta shade, to take the life out of the colored sketches. On examining the individual drawings I was rather impressed with the lack of variety in style, particularly among the pen-and-ink sketches. The water-color drawings were almost uniformly admirable, and there were several masterly sketches in Payne's gray and sepia, and in pen-and-ink with a faint tint over it; but the pen-and-ink drawings pure and simple generally followed very closely either the style made familiar to us by Norman Shaw, or that of his rival as a draughtsman, T. Raffles Davison. Of course, to be reckoned even as a distant imitation of the work of these great masters, a drawing must be tolerably good, and, excepting one unfortunate pencil-scrawl, enlivened with streaks of brick-red pastel, I did not see a single poor drawing in the room, although several, particularly among the sketches of interiors, might with advantage have had their perspective more carefully constructed. There were something more than two hundred frames on the walls, the list of contributors including the names of nearly all the most distinguished architects in England, and the room while I stayed in it, was fairly well filled with interested visitors.

One must expect, I suppose, that people in general will be more attracted by paintings than by architectural drawings, and, whatever may have been the relative capacity for appreciating what it saw of that portion of the British public which strayed into the architec-

[1] Continued from page 17, No. 550.

tural room, and of that which did not get beyond the paintings and the black-and-white work, it is certain that the latter was much superior in point of numbers.

In one of the first rooms that we entered we found great attention excited by a magnificent ceiling decoration, painted, if my suspicions are correct, for a house in New York, by Sir Frederick Leighton, the president of the Royal Academy, and the most accomplished painter that it contains. The ground of the ceiling was a bright, pure, golden tint, and on this the design was drawn, in panels, separated by beautiful ornamental bands, and containing simple groups of figures and accessories, arranged with almost perfect symmetry, and painted in full color. There would hardly seem to be anything particularly novel about this treatment, yet, on comparing it in my mind with other ceiling decorations, I was unable to think of a single one which could be called even remotely similar. There are flat-tinted ceilings enough with conventional decoration, and ceilings enough with figures in full color, but with a ground of clouds and sky, and there are also to be found figure-decorations with plain grounds in real or imitated fresco, but the idea of using a plain ground for figure-work on a large scale, and to do the whole in full, rich color, is just what one might have expected to occur first to a man so thoroughly accomplished and so free from hobbies and prejudices as Sir Frederick Leighton. It is fortunate also that he should have been among the first to attempt carrying it out. A feebler man would have been inevitably overthrown by the multiplied embarrassments of keeping the figure-painting conventional enough to agree with the decoration, yet natural enough not to look affected, and sufficiently bright to resist the contrast of the trying background; but the complete success of the lovely painting gave no suggestion of the difficulty of its execution, and the muses, or whoever they may be, smiled as sweetly from the canvas as if it had been an every-day affair to put them there.

The next picture of special interest was a portrait of Mr. R. Norman Shaw, by J. C. Horsley. The architect was very cleverly and simply painted in an easy attitude, with a drawing-board before him, and drawing materials scattered about, and although the portrait was hardly so strikingly picturesque as Herkomer's great sketch of Mr. Richardson, it seemed to me one of the best there, which is saying a good deal. I was disappointed to find only one portrait by Sir John Millias, and that a rather uninteresting one, but there was a picture of Millais himself which had the interest that the other lacked. Judging from the portraits generally, the English painters follow the example of the good old Dutch masters in not flattering their subjects. A picture of Mr. Joseph Chamberlain which was interesting on account of the political prominence of the gentleman whom it was supposed to represent, was about as well calculated to alienate his friends from him as a portrait could possibly be. My first conclusion on seeing it was that if I were an Englishman no persuasion would induce me to follow the lead of a person so repulsive. To judge from the portrait its subject would seem to have combined the worst characteristics of the Reverend Mr. Chadband and the late Emperor Napoleon III, and I did not get wholly over the impression produced by the stooping figure, the smooth, wily face, and the crafty eyes, until I read, two or three days after, the manly speech in which he offered his services for the next Parliament to his constituents.

I had been prepared to find that the "impressionist" pictures, of which we hear so much across the water, would not be numerous in the Royal Academy exhibition, but there was one large composition by Mr. E. Burne-Jones to which I turned with eager expectation. At first sight it had the appearance of a piece of old leather, faintly decorated with the image of a fish, but the catalogue said that it was meant to represent the "Depths of the Sea," and explained it further by a quotation from Virgil, which seemed to indicate that somebody had got everything that he or she was so wretched as to want; and as this did not seem to be intended to apply to the spectator, I concluded that it must be appropriate in some way to the fish, which, in fact, turned out to be a mermaid, holding a large-sized man on her shoulder. Both the individuals concerned seemed, so far as any expression was visible on their countenances, to be contented with their lot, and as they seemed to need no sympathy from any one else, I was glad to turn to the next subject.

Our time in London being short, I hurried through the Royal Academy, in order to finish the day at the Grosvenor Gallery, which occupies a modest, but rather prettily-arranged set of rooms in New Bond Street. The first impression of the exhibition was certainly superior to that produced by the first sight of the Royal Academy collection. Something of this might have been due to the superior coloring of the Grosvenor paintings, but the smallness of the rooms seemed to me to help the pictures, and the lighting was much pleasanter.

Every one knows that the Grosvenor Gallery is the refuge for all sorts of artistic eccentricity, and I began my examination of the individual pictures with much curiosity. As compared with the Royal Academy exhibition, in which a decorous legginess seemed to be only sparingly tolerated, the Grosvenor collection abounded in nude figures of various sorts, and there was also a noticeable difference in the portraits, many of which were treated in a beautifully picturesque and interesting way. The worst of the pictures, as it seemed to me, were those about which the catalogue appeared to endeavor to throw a sort of misty sentiment, by means of poetical quotations, enigmatical titles, and so on. There was a good many of them, for the notion that feeble pictorial skill can be helped out with literary taste is very prevalent in England, and nowhere more than among the æsthetic public which supports the Grosvenor Gallery, and sentimental circumlocutions took the place of titles to a large portion of the paintings. This had one disadvantage, that in many cases there was no obvious connection between the pictures and the titles. If the catalogue said that something by Mr. Burne-Jones was intended to represent "Flamma Vestalis," it was tolerably safe to assume that the subject would be a girl, and the "Soul's Prison," the "Forlorn of Paris," "A Field Flower," "Hope," "Thoë," and so on, were pretty sure to represent young women, although it was not so evident why the "Forlorn of Paris" should wear no clothes but a trifle of mosquito netting, or why "Hope" should have had a broken neck. When, however, the ambition of the painters carried them beyond the portrayal of imperfectly-clad girls, the indirectness of the titles became embarrassing. One picture, for instance, which seemed to indicate a simple nose-rubbing scene, between two persons with features admirably formed for this purpose, was, as the catalogue said, intended to represent Francesca da Rimini and her cousin, on that occasion when, according to the proof-reader's rendering of Dante's libellous lines, they "*leggramo un giorno per diletto*," while another, showing a girl without clothes standing by a pond, was, as it seemed, designed to illustrate an incident in the life of Joan of Arc, regardless of the circumstance that Joan of Arc, at the period to which the incident referred, was about forty years old, and would hardly have gone down to ponds to bathe without protecting herself with an old gown and an umbrella. If this had been all, one might simply pass over such pictures with the reflection that the titles were probably an afterthought, but some, even of the simplest and worst pictures, were dished up with a Tuscan-Dante-Arno-Francesca sauce that turned one's stomach. A lead-colored affair, apparently depicting a number of greenish feather-dusters sticking up from dump-heaps of dirty snow, with a watery-looking streak in the distance, was denominated "Leghorn from Bocca d' Arno." If the mouth of the Arno looks so, it must be a miserable place; but this was not so bad as another attempt at a landscape, which was honored in the catalogue with six lines of poetry, in printer's Italian, given as a quotation from an "Inno di S. Francisco d' Asisi," or as two or three compositions, resembling portions of boarding-house hash rather than landscapes, which had, as the catalogue informed us, been painted for St. George's Guild.

ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

HOUSE FOR CHARLES L. TIFFANY, ESQ., ON SEVENTY-SECOND NEW YORK, N. Y. MESSRS. MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.

[Gelatine print issued only with the Imperial and Gelatine editions.]

PRIZE DESIGNS FOR A $5,000 HOUSE, SUBMITTED BY MR. H. C. BURDETT ("*Normandie*"), BROOKLINE, MASS., MR. E. F. MAHER ("*Charles Dickens*"), BOSTON, MASS., AND MR. F. CRAIGIN ("*Scotch Thistle*"), HARTFORD, CONN.

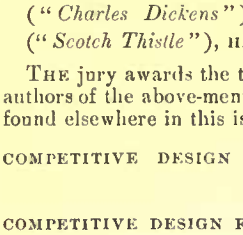
The jury awards the three equal prizes of fifty dollars each to the authors of the above-mentioned designs. The jury's criticism will be found elsewhere in this issue.

COMPETITIVE DESIGN FOR A $5,000 HOUSE, SUBMITTED BY "*Birdseye.*"

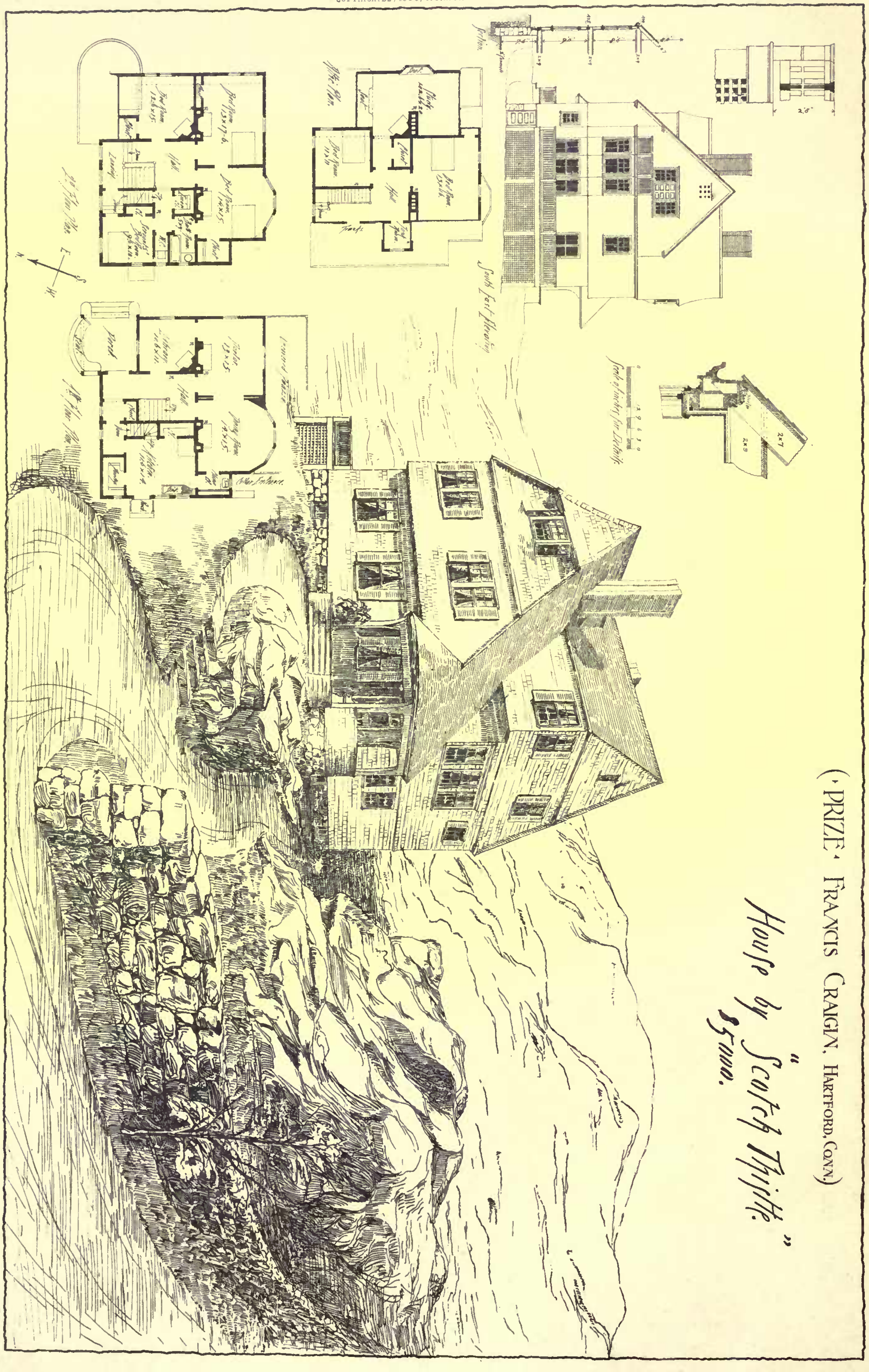
COMPETITIVE DESIGN FOR A $5,000 HOUSE, SUBMITTED BY "*T. T. R. & B.*"

DINING-ROOM FOR S. M. NICKERSON, ESQ., CHICAGO, ILL. MR. AUG. FIEDLER, ARCHITECT, CHICAGO, ILL.

REMUNERATION FOR WORKS NOT EXECUTED.

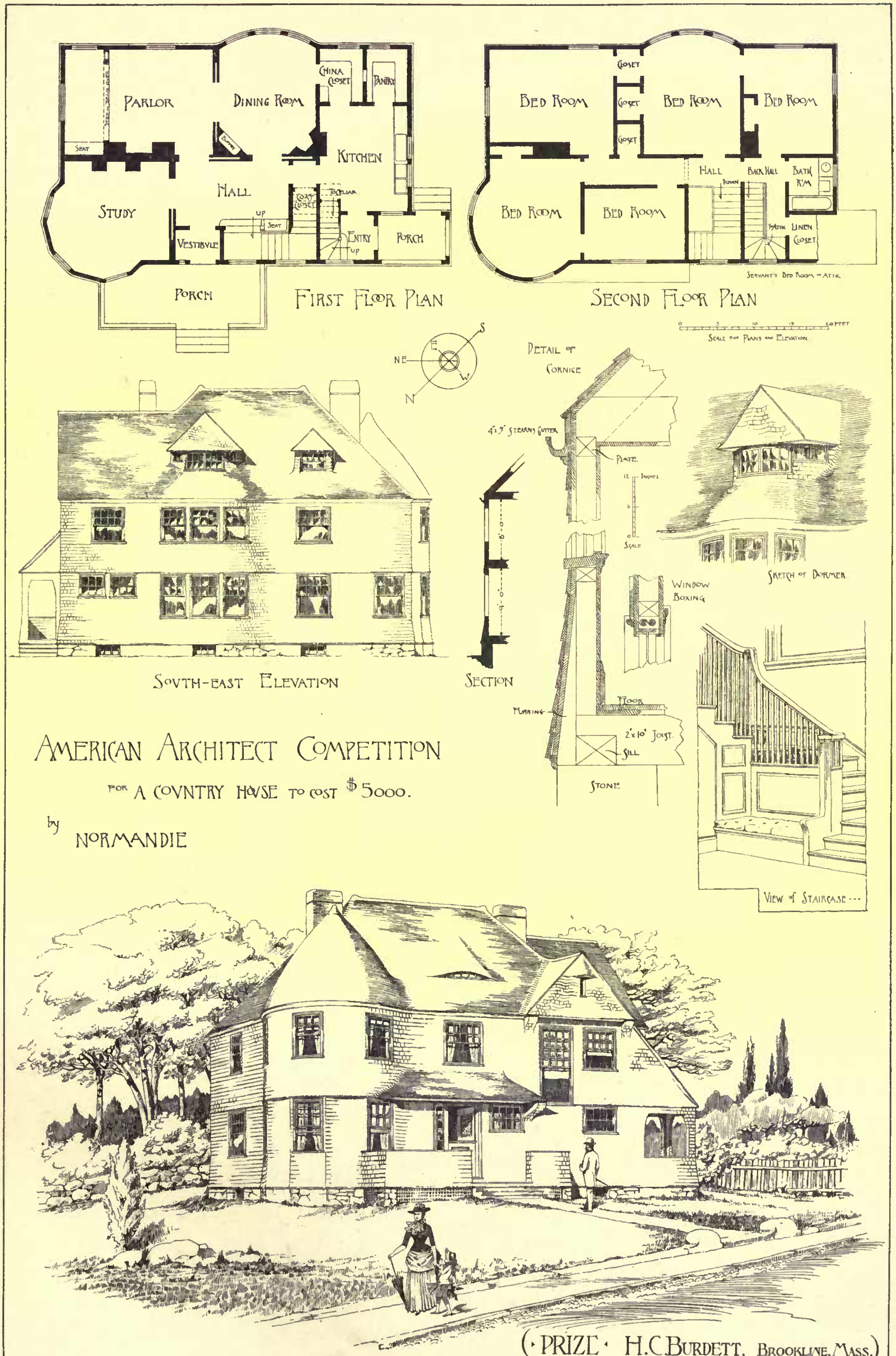


When an architect, by a special arrangement with his employer, agrees to a certain remuneration, the work is only partly carried out, and he is then dismissed — is he legally entitled to charge the usual percentage and to claim two and one-half per cent on the cost of work which has not been executed under his supervision? Such is the question which has been recently brought before a legal tribunal, and was reported in our last issue as settled by the defendant offering to increase the sum paid into court and to pay all costs. In this case the main consideration seems to be the cause of the dismissal. If the architect is dismissed without a sufficient cause being assigned, as it appears was the case in the instance mentioned, there is no doubt whatever the architect is entitled to throw over the agreement and to claim his usual commission. Neglect, incompetence or misconduct



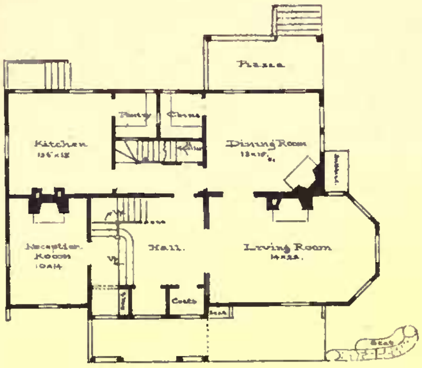
(Prize) Francis Craigin, Hartford, Conn.)

House by "Scotch Thistle" $5000.

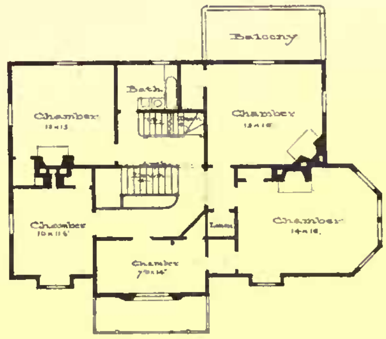


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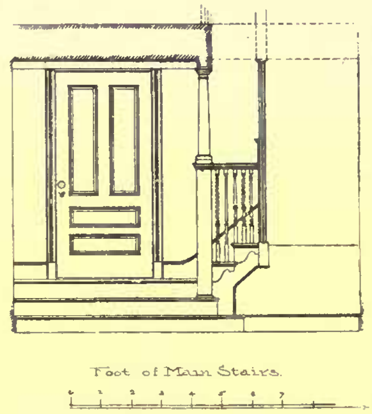
AMERICAN ARCHITECT AND BUILDING NEWS, JULY 17 1886. No. 551



First Floor



Second Floor

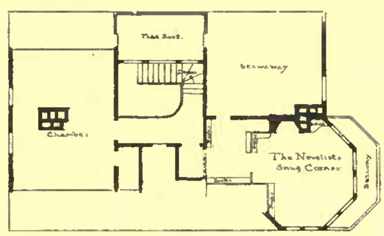


Foot of Main Stairs.

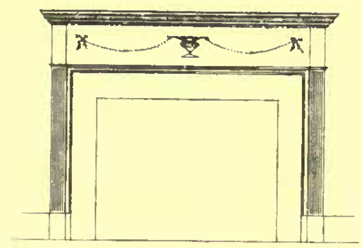
Scale for Plans & Elevation



North-East Side

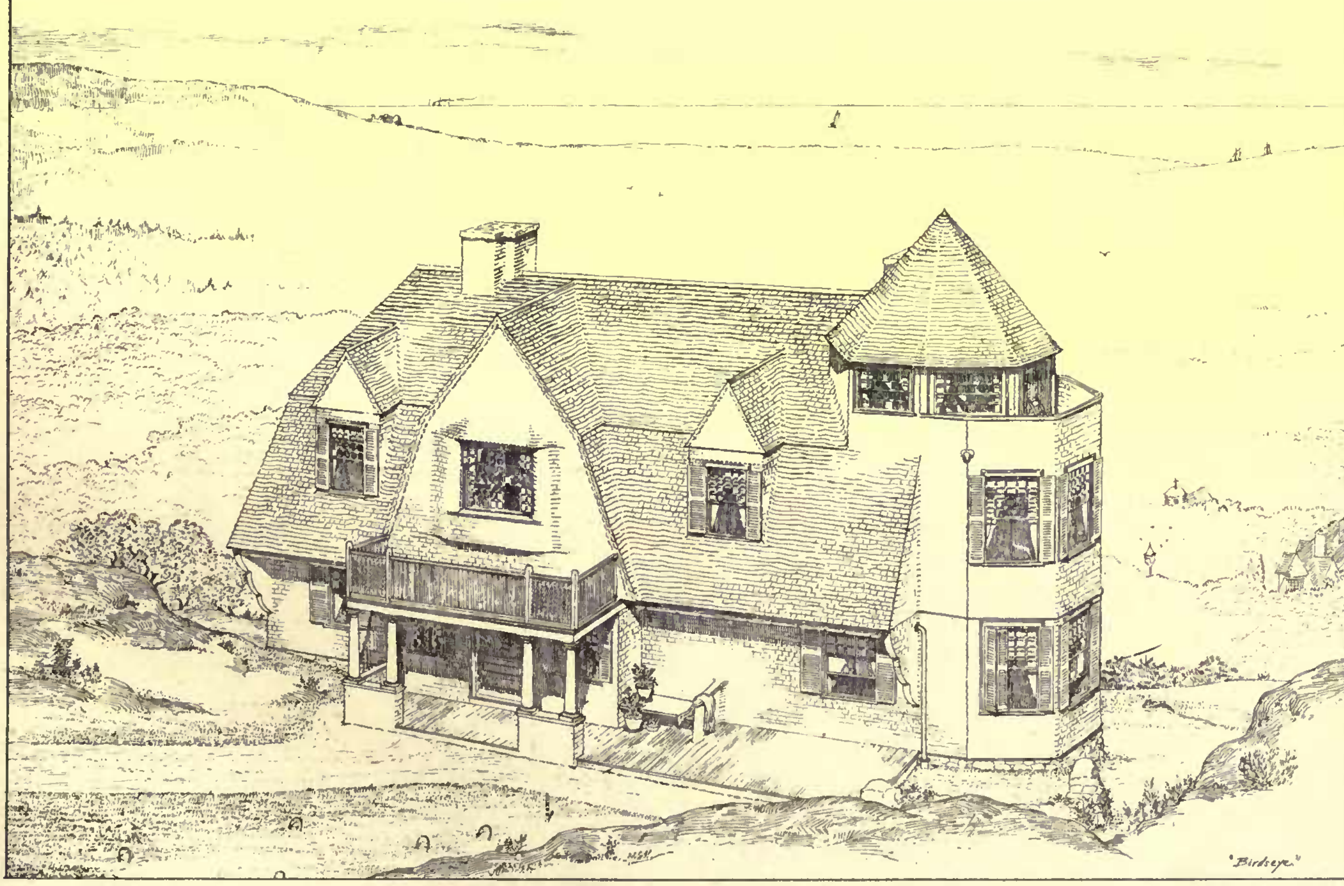


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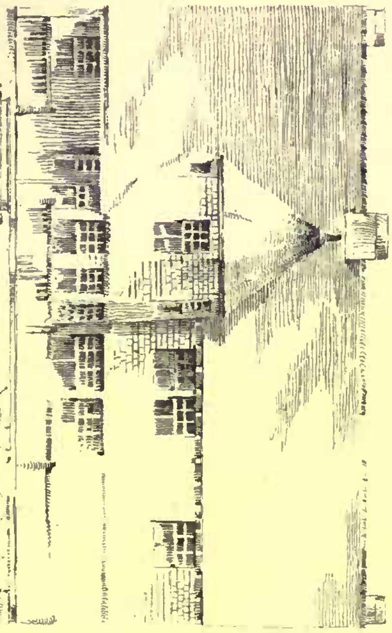


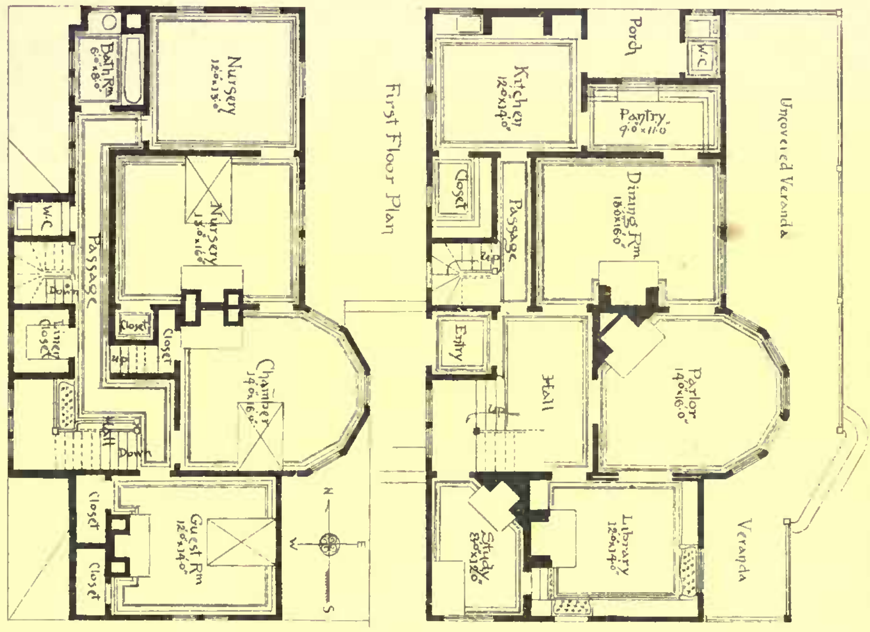
Parlor Mantel.

American Architect Competition.
Subject:- A NOVELIST'S HOME.
Design submitted by "Birdseye."



HELIOTYPE PRINTING CO. BOSTON





AMERICAN ARCHITECT COMPETITION

Design for a $5000 House

Submitted by "Charles Dickens"

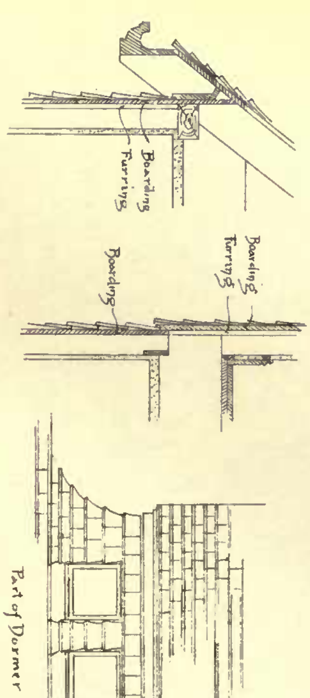
Scales

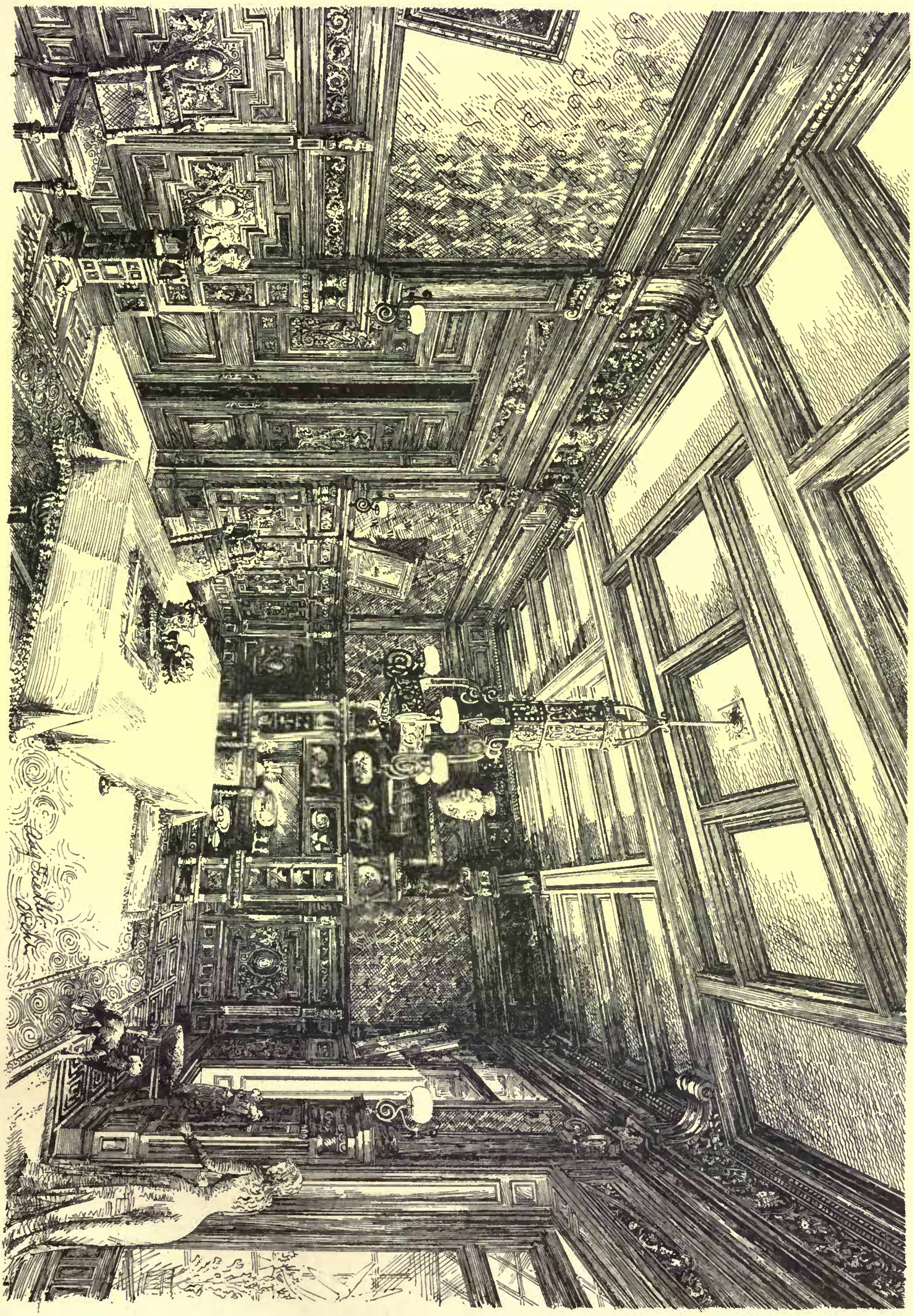
For Details 3 Feet

For Plans and Elevations 10 Feet



(·PRIZE· EDWARD F. MAHER, BOSTON, MASS.)





Dining Room. Residence of S. M. Nickerson. Esq Chicago, Ill.

HELIOTYPE PRINTING CO. BOSTON.



ST. AUGUSTINE, FLORIDA.

SKETCHES BY A. W. COBB.

would have to be proved in order to make such a dismissal a reasonable plea. Clients have strange whims sometimes; they imagine the architect is neglectful if he does not appear every other day on the works, or that he is endeavoring to add to the expense, or is in alliance with the builder. On the other hand, suppose there is a ground for dismissing the services of the architect. Is he, under the circumstances, entitled to make the usual charges? It is very questionable if he can do so. Let us imagine that the client alters his mind and decides not to go on with the work, or to save the further expense of the architect. Such a contingency is not contemplated at the beginning, and there has been no written or implied understanding to pay extra for what is so suddenly broken off. Is the architect to be satisfied with a nominal remuneration under such circumstances, or can he charge his full commission? There are many in the profession who would certainly think they were fully justified in setting aside the agreement, and we think the law would support them, if it could be proved that such an understanding was made only under the belief that the building would be fully carried out. The circumstances brought into notice by the case to which we have referred are instructive, at least to the profession, in several ways. Two things are clear. The first is that any agreement made between architect and employer should be in writing; the second, that in case the services of the architect are dispensed with, he should be entitled to claim the usual remuneration of five per cent on all executed work, and two and one-half per cent on all work not executed. We know of a few instances where the architect has been careless of the way in which he has been appointed — that is to say, his engagement has been of a very slight character, perhaps a talk-over with the building owner in a friendly way. A promise by the former to prepare a design on approval is made. When the charges are sent in, the bill is disputed; the defendant denies having given any instructions, or, as in another case, alleges the engagement was only contingent on some event. The case of "Wykes *vs.* G. H. Macdermott" is in point. The plaintiff was introduced by a builder to the defendant, both being interested in the erection of a theatre. He was instructed by him to submit a design; drawings were prepared and submitted to the defendant; interviews took place. Want of funds prevented the builder finishing, and he subsequently filed a petition, and the negotiation came to an end. The plaintiff thereupon brought an action, but the defendant denied that he ever gave any instruction to the plaintiff; the matter was simply talked over in a friendly way, and the defendant further denied having anything to do with the scheme. In cross-examination he said whatever he did was contingent upon his being made a partner in the concern. The verdict was given in favor of the plaintiff. Not unfrequently the architect finds himself mixed up in a business, though he has no definite instructions from any person. It may be suggested by a friend that he should send in plans, and these are adopted, but without any request from any individual. The work is perhaps abandoned, and he finds he has no legal claim.

Now in law an architect may have prepared a set of plans, and work may have been performed, and yet without being able to show a previous request he may not be able to substantiate his claim. There may be nothing to show there was anything obligatory on the alleged employer to pay; in short, there has been no "retainer" of the architect. In point of fact, the person cannot be charged with it unless it has been done by his orders, or unless he, by accepting the benefit of the work done, impliedly engaged the architect. This implied request is the only ground of action in such circumstances. The architect who works his way into a position has seldom, indeed, any trouble in substantiating his claims; there is generally some correspondence from which an implied request may be derived, if there is not a contract in a formal manner. He is safer, however, if he proceed on sure ground, and for this purpose a "retainer" is necessary, and a retainer may be simply a request, as, "I engage you to prepare plans and carry out such and such work," which may be verbal, or, if the agreement is not capable of being performed within the year, then in writing. The retainer and its acceptance establishes a contract, from which it is impossible for either to free himself; hence the importance of the negotiations being entered into in a formal manner. Till both parties are agreed, either has a right to be off to do as he likes, a rule of law which cannot be too clearly or tenaciously remembered by the architect in his dealing with individuals.

A form of agreement between architect and building owner, parts of which might be usefully adopted, is suggested in "*Emden's Law of Building.*" The substance of the agreement is as follows: 1. The architect will prepare sketch plans and all necessary drawings of intended building, having regard to the proposed cost, so that a contract may be made for it. 2. If the employer abandon the intention of building, the architect shall be entitled to a sum to be fixed, and to the return of his sketches. 3. If the sketches are approved, and the said employer desires to proceed, the said architect shall, by a day to be named, prepare working-drawings and specifications for competition by builders. 4. The drawings and specifications shall be full and complete. 5. If the most approved tender exceeds the amount proposed, the architect shall, if required, revise his plans so as to bring the expenditure within the prescribed limit. 6. The plans and documents shall be the property of the said employer (*i. e.*, at once, not merely after the work is done), and the architect shall make at his own expense all copies necessary. 7 and 8 apply to certificates and clerk-of-works. 9. The architect will be at liberty to vary architectural details, provided such variations do not involve extra cost, but shall on no account incur any increased expenditure without sanction of the said employer in writing. 10. If any additional or substituted works become necessary, the architect shall furnish the plans, etc., as soon as possible. 11. The architect's remuneration shall be a fixed sum to be agreed on beforehand, and one-third of it shall be paid to him on the execution of the contract, another third when half the contract price has been paid to builder, and the rest when the last payment has been made to the builder. 12. If after the working-drawings are made the employer does not proceed, the architect shall be entitled to a fixed sum to be agreed beforehand, and the plans shall belong to the employer. Or if the employer proceeds only with a part of the works, the architect shall be entitled to a proportionate part of the remuneration mentioned in 11, in addition to a proportionate part of the sum mentioned in this article in respect to the work abandoned. 13. The architect shall be entitled to nothing more except for alterations and additions made by written authority of employer. 14. In that case he shall be entitled to such increased remuneration as may be agreed on or determined by arbitration. 15. If the architect becomes incapacitated or dies, he or his representatives shall hand over to said employer all plans and papers, and shall be entitled to such equitable proportion of the unpaid part of the remuneration as may be agreed on. 16. Disputes to be settled by an arbitrator. 17. No rules of the R. I. B. A. or any other society to be held binding on the employer. Exceptions will be taken to Clauses 6, 15, and 17. The form we have summarized is the substance of the Government agreement, including suggestions by Lord Grimthorpe, and, though fairly open to reconstruction in the three clauses named, is fairly well devised to meet the case of abandonment of the work by the employer, either at the commencement or after some of the work has been performed. Referring to the question of remuneration in such cases, the custom of the profession, when the employer abandons his intention after the plans and specifications have been prepared, is to charge a commission of two and one-half per cent, with an additional fee of one-half per cent if tenders have been procured. A better arrangement may be made beforehand by agreeing to a sum, as in Clause 2, whenever there is any doubt as to the work being carried out. More difficulty arises when the work is only partially carried out. The architect may, by custom, charge his two and one-half per cent, and a further commission of two and one-half per cent on all executed work certified by him. It by no means follows that the building owner will consent to this, especially when only a portion of the drawings are prepared; but by previous agreement the remuneration may be fixed as in Clause 12, a sum being agreed for all the drawings and documents prepared, and the superintendence charged for up to the time of abandonment at the usual rate. This mode of determining the remuneration would be less open to question than that suggested by taking a proportionate part of a fixed sum, which proportion would be difficult of estimating when the architect's work is divisible. In cases of abandonment by the building owner, the property in the plans often becomes a question. The owner thinks he has a full right to drawings prepared expressly for his work; but, under these circumstances, the architect is less disposed to forego what he considers he is entitled to by custom. The thought of some one else being engaged to complete his design from the same plans is repugnant, to say the least. These are doubtful points. When it is made a condition in Government works to insert clauses requiring that the drawings are to be given up to the employer, we fear it will be a long time before the law will recognize any custom of the profession.

We have ventured to bring these questions before our readers because they are still open to doubt. Agreements for remuneration are often made in the case of large works. The architect, perhaps, is willing to throw off one per cent for a large, plain building; but he does not certainly agree to accept a proportionate sum if the work is abandoned, or his services are dispensed with. Yet this contingency is unexpected; it is never contemplated by the architect. But if a provision were made for works abandoned, or services dispensed with, such difficulties could not arise. A well-considered form of agreement, intended to meet these possibilities, ought to be drafted, in which the sum may be left to the parties themselves; but determining a rate per cent upon all executed work. The American Institute of Architects adopt a schedule in case of abandonment of work which appears to be reasonable. Thus the charges for partial service are as follows: Preliminary studies, one per cent; studies, including general drawings and specifications, two and one-half per cent; and the same, including details, three and one-half per cent upon the entire cost. The Western Association have also adopted the schedule, and have resolved that the architect should in all cases superintend the work designed by him.— *The Building News.*

STAINING BRICKS.— For staining bricks red, melt one ounce of glue in one gallon of water; add a piece of alum the size of an egg, then one-half pound Venetian red and one pound of Spanish brown. Try the color on the bricks before using, and change light or dark with the red or brown, using a yellow mineral for buff. For coloring black, heat asphaltum to a fluid state, and moderately heat the surface of the bricks and dip them. Or make a hot mixture of linseed oil and asphalt: heat the bricks and dip them. Tar and asphalt are also used for the same purpose. It is important that the bricks be sufficiently hot, and be held in the mixture to absorb the color to the depth of one-sixteenth of an inch.— *Scientific American.*

THE PREVENTION OF FIRE-RISKS FROM ELECTRIC LIGHTING.[1]



Sketch-Model for Monument to Garibaldi. Nice. Etex Sculptor.

It has been customary of late when the slow progress of electric lighting has been discussed, to abuse the Electric Lighting Act of 1882, and to make this measure, together with the stringent regulations of the Board of Trade, the reason for the absence of the necessary working capital which made so many of the companies, promoted to work particular systems, retire from business. Whether this was the case or not, is not my intention to discuss, but reliable authorities have often stated that, with our former knowledge of the subject, it would have been impossible to have undertaken to supply electricity to the public commercially in the same way as they are accustomed to obtain gas. That the question of supply and cost does not altogether prevent the adoption of a superior method of lighting is very clearly proved by the increasing number of proprietors of clubs, hotels, and occupants of houses who, after waiting in vain for electricity to be brought to their doors, have determined to produce it themselves, and for this purpose have set up the necessary plant.

We are accustomed to look upon electricity as that "invisible subtle fluid" which we use with impunity for ringing bells and actuating telephones, and are ready to take it, in the form of electric light, into our houses without any thought; the electric current necessary for lighting purposes, when uncontrolled, is far more dangerous; at the same time, if properly installed, it is rendered as harmless as that from the galvanic battery, with which every one is more or less familiar. The supply of electricity which may be furnished by any of the various systems, may be either generated direct from the dynamo, or it may be stored up in secondary batteries, wrongly termed accumulators, as they do not accumulate, but store up, electrical energy; also, it can be produced on a small scale by a primary battery similar to those used for telegraphic work, but larger. Whether from either one of these three methods of supply, and which ever system is adopted, the electricity is precisely the same and only differs in that one current may be of higher pressure, or, as it is termed, of greater electro-motive force than another, according to the construction of the battery or dynamo machine. These transform the zinc or the power derived from the fuel, and furnish electricity to suit the incandescent or arc lamps, the light from which is only electrical energy in the form of heat. The source of danger is that this heat may be produced where it is not wanted, and thus cause "fire." The prevention of this electrical *bête noire* has already occupied considerable attention both in this country and abroad.

A special Fire Risk Committee, appointed by the Council of Telegraph Engineers and Electricians, was formed in 1882, and some excellent rules were drawn up which have been adopted, in a modified form, by some of the insurance companies, and have been added to the excellent paper read by Mr. Slater before the Royal Institute of British Architects in 1882, but neither these nor the standard of requirements of the New York Board of Underwriters can be said to embrace all the changing details of electric light installations, which can only be ascertained by practical experience that already has considerably added to the knowledge possessed when the committee was sitting.

The first source of danger is in the main and branch wires which conduct the electricity about the building to be lighted, and which are run in much the same manner as gas-pipes. If these conducting wires are of sufficient area and of a material whose resistance is uniform, the current in its passage will develop no injurious heat, and there will be little risk from this cause. Whatever resistance the conductor possesses will cause heat, which will vary with the amount of electricity passing, and inversely as the sectional area of the conductor. This term "resistance," which is used by electricians, must not be confounded with the ordinary meaning of resistance to tension or to rupture. It is a misfortune that the term has been too fully introduced, as it would have been better to speak of the conductivity of a wire. The energy needed to cause the supply of electricity to pass through the conductor has been compared to the difference in the head of water necessary to cause a quantity of fluid to overcome the resistance of a pipe, but its action is totally different. It more resembles water soaking through sand, in that the whole of the cross section of the wire interposes a resistance which, in large conductors, doubtless varies proportionately to the temperature of each section according to its distance from the outside radiating surface.

In order to avoid any tendency to heat, the branch mains and leads which conduct the electricity to the lamps, should be of ample area. The following table may be taken as a guide in estimating the gauge for wires used in the interior of buildings, but where the electric current has to be distributed over a large district, the sectional area must be calculated in a more accurate manner in order to have the most economical proportion.

Table of Sizes of Main and Branch Wires or Leads for Swan 16-candle-power Lamps (nominal 20 candles) and Edison 16-candle-power Lamps.

Number of Lights to be worked.	For 45 to 65 Volt[2] Lamps, taking 1.5 to 1.1 Ampères.[3]		For 90 to 110 Volt Lamps taking 0.8 to 0.625 Ampères.		
	Wire diameter.		Wire diameter.		Branch Leads.
	.048 inches.		.048 inches.		
1 or 2	.072 "		.064 "		
3	.128 "		.104 "		
10					
	No. of Strands.	Diameter.	No. of Strands.	Diam.	Main Leads.
20	7	.072	7	.064	
25	9	.072	7	.064	
48	19	.064	7	.080	
65 to 75	19	.080	19	.064	

Silver has the highest conductivity of all the metals, and if the price continues to decline, it is within the bounds of possibility that it may be used for winding dynamos, but copper will always be used for electric-light cables; first, because it can be obtained in a purer state than any other available metal, and, secondly, because next to silver it is the best conductor of electricity. It may be interesting to note how much the use of copper wire is extending for telegraphic purposes from the fact that the post-office have recently erected a copper wire, .080 in diameter, from London to Newcastle, 278 miles in length, and by its use have been able to increase the number of words sent per minute from 345, the best result with iron, to 414.

The resistance of all metals is greatly increased by any impurity, therefore it is particularly necessary in purchasing copper wire to see that its conductivity is never less than ninety-six or ninety-eight per cent of the pure material.

THE RUNNING OF WIRES.

From the familiar way in which electric bell-wires are laid about a house one is apt to imagine that electric-light conductors can be treated in the same manner. To do this would not only be committing a great error, which might at any time cause the break-down of the light, but also might occasion a very dangerous fire.

The position of all wires should be carefully planned, and they should be led in such directions that they can be got at for the purpose of testing and verifying the soundness of the joints. To do this the main wires in a building should be carried under the floor above the rooms to be lighted. Having selected well-insulated cable it may be run along or across the joists, being kept from touching the wood itself by some good insulating material, such as asbestos mill-board. The position of each joint or branch should be marked on the removable floor-board which rests over the cable, and this is especially necessary if the cut-outs or fusible safety-junctions are fixed here so that they may be quickly got at to renew the fuses when melted. The branch wires can by this plan be easily led to descend into the rooms below at points where each light is required; if taken down the walls they should not be bricked in, but inserted in a wooden groove which has a removable cover flush with the side of the walls, that can be either painted or papered over to match the decorations, or, if mouldings are already used, the grooving can be covered with a false moulding or beading to match the other. Wires thus protected are not only safe from being injured by settlement or by the gnawing of rats or mice, but being in a known position can be avoided when structural alterations are made. In wiring a house, the connections to the switches or contact-breakers, which are used to shut off the current, must not be forgotten. It is as well to provide for a switch to turn out the lights on each landing independently of the main switches, which should be fixed on a board also containing the cut-outs in the engine or battery room, or where the current is supplied to the house; near the door of each room a small switch should be placed that one or more lamps can be turned on when entering; this is especially useful in bedrooms, obviating the use of the chamber candlestick. In the living-rooms the lights may be grouped; that is, the wires of several lamps can be connected to one switch, and one or two lamps only be united to another; these lamps can thus be kept alight when the room is unoccupied.

ELECTRICAL CONNECTORS AND JOINTS.

Special attention should be paid to these, especially to those connections made with binding screws, which must be firmly screwed up, as bad contact between a wire and a terminal will produce heat and loss of current. The wire should fit the hole in the binding-screw, which should be tightened while the current is passing if found to be loosened by the expansion of the metal due to heating.

All electrical joints, such as those between the two main cables or where a branch lead is taken off, must be carefully made; otherwise the calculations as to the efficiency of the cable may be upset and an efficient installation be spoiled by a faulty junction. Solder alone should never be relied on for electric-light joints. If ever so little heating takes place the solder may be softened by the action of the

[1] A paper by Killingworth Hedges, M.I.C.E., and Member of the Society of Telegraph Engineers and Electricians, published in the *Builder*.

[2] The Volt is the term used by electricians to express the practical unit of E.M.F., electro-motive force, or difference of potential. It is about .976 of a single-cell Daniell battery.

[3] The Ampère expresses the strength or intensity of current. If an electro-motive force of one Volt is used to send a current through a wire having the resistance of one Ohm (*the unit of R, resistance*), the strength of current, if measured, will be one Ampère.

current, which tends to reduce the alloy to its component parts, thus allowing the copper wires to separate, when a dangerous arc will be formed, which will speedily destroy the cable. A joint must be made mechanically perfect, and considerable pressure used to bring the surfaces together; the solder may be then applied to keep the whole air-tight, but in no case should any joints be made except by workmen accustomed to electric-light work.

SHORT CIRCUIT.

The term explains itself, and means that the electric current, instead of going the circuitous course allotted to it, takes the shortest path, where, having no work to do, it causes fire. Accidents from short circuit may be divided into three heads: —

1. One of the conducting wires may either come directly in contact with the return conductor, or something metallic, such as a staple carelessly fixed, may cause an electrical connection.

2. Some good conductor may momentarily touch the unprotected surfaces of two wires and cause an arc to be formed between them, or either one of them may be "grounded;" that is, put in circuit with the earth.

3. The same result may be accomplished by water dripping from one wire to the other, or by a badly-insulated cable being laid in a damp place or on a wet beam.

Accidents have occurred from each of these forms of short circuits, which, however, will never happen if the wire is thoroughly insulated and the protective covering is not damaged. There is one exception, and that is, where water is the cause of the trouble, when only an impervious material, such as gutta-percha, will be a sure preventive. The so-called fireproof insulation is useless if not waterproof; even the lead-tube covering for cables, which has been so highly recommended, appears to be an element of danger. In the mines of La Peronnière, France, a fire was produced by the electric current short-circuiting through the insulation onto the lead envelope, which, being in contact with the damp ground, led away the electricity and speedily burned up the cable.

CUT-OUT, OR SAFETY-FUSES.

This important fitting is, in fact, the "safety-valve" of an electric-light installation, and may be compared to the weak link in the chain which gives way before any damage can be brought about, by excess of current liable to render the conductors and their branches red-hot, and also prevents the evil effect of a short circuit. The Fire Risks Committee's rules describe a cut-out as "a piece of easily fusible metal which would be melted if the current attains any due magnitude, and would thus cause the circuit to be broken."

The Board of Trade regulations state "that this fuse shall be of such a nature as to cut off the supply of electricity when the current exceeds by fifty per cent the maximum current which the service line is intended to supply." It is true that a smaller margin than fifty per cent may be used, but this is not compulsory, and I think should be so, unless the fuse may be absolutely relied on to melt with that excess of current. The plan introduced by Edison of inserting a lead or copper wire into the circuit is particularly bad, as a dangerous arc may be formed before a lead wire, designed to melt with a fifty per cent margin is ruptured. Anyhow, the cut-out should be rapid in its action, and of a material quickly melting at a lower temperature than lead or copper, so that molten particles could not set anything inflammable on fire. In order to ascertain which was the most suitable material, I tried a variety of metals, and found that if their area was much more than a fine wire of two or three millimetres, they were absolutely unreliable, and even then, when melted, threw portions of the hot metal about the room. Lead wire, which is often used by ignorant people, is far the worst, as it oxidizes after a length of time, and gives trouble on account of its expansion and contraction; and the alloys of tin and lead, which conduct the electricity in the same ratio as would separate wires made of their component parts, gradually become altered in resistance by the passage of the current. This is noticeable in whatever form the alloy is used, so that safety-fuses, which have been tested to melt with one hundred ampères, have, after a month's work, melted with seventy-five ampères. Another great disadvantage attending the use of a fuse of large sectional area is the disruptive effect which takes place at the time of fusion. This only applies to the very large fuses, such as are used to protect the dynamos in the Edison system, and so violent is their action that the top of an iron box laid in the streets of New York was displaced by the rupture of a safety-fuse underneath. The difficulty is overcome either by using rods of fine tin wire, or, better still, by making the fuse of strips of metallic foil, the particles of which, when melted, do not take a globular form, and are almost oxidized by contact with the air. After experimenting with numerous foils, I obtained a special alloy of aluminium — a metal which has a great future for electrical purposes, and has the advantage of great tenacity, so that very thin foil can be used. Strips of this foil are placed between layers of mica, due care being taken to allow for the expansion of the foil; the strips are thus built up like the leaves of a book, according to the melting value required. For small currents, the foil is fastened by means of two eyelets to a single strip of mica, which can be easily removed and replaced, even when the current is passing, owing to the high insulating character of the mica.

The use of cut-outs to protect an installation appears to be a crude remedy in that the lamps are generally extinguished when the fuse melts; this, although a small matter where the question of fire is at point, need not be the case if a simple arrangement of "bye pass" circuit be employed, so that the supply of electricity may be automatically reduced by a resistance until a new safety-fuse is inserted. A still simpler plan, and one almost universally adopted in the best installations, is to fix a double cut-out, termed "the duplex pattern," which contains two mica foils, one of which only is used to protect the circuit, but directly it fuses the second foil, having a much higher melting value, can be inserted by turning a small lever. The object of causing the second fuse to carry more current is to prevent the extinction of the lights while the fire is being replaced; however, if the trouble is due to a bad short circuit, both foils will be melted, which is the safest plan and one that should not cause more than half the lights in any room to be extinguished if the system of wiring the lamps from two separate dynamos be employed.

AUTOMATIC CUT-OUTS.

This class of instrument cannot be recommended in preference to the fusible cut-out, in the first place because it encourages carelessness on the part of the attendant, who may allow the current to increase, and, consequently, extinguish the lights without having the necessity to renew a fuse, which would betray the circumstance of the extinction. Secondly, an automatic cut-out may fail if it has been left for a long time unworked, and this mishap is especially to be guarded against with those in which mercury is used to make contact, for the reason that the mercury might be deflagrated, when the fumes would produce very dangerous results.

SAVING OF LAMPS.

The percentage of losses of incandescent lamps is not high, if breakages and similar accidents only are taken into account, but the average total is swelled enormously by the number of lamps which are prematurely burned out by too much current being allowed to pass. It was recently stated, in a paper on the "Electric Lighting of Steamships," read at the Institution of Civil Engineers, that "out of two hundred Swan lamps on board a large passenger steamer, fifty were suddenly broken through a failure of the governor." In this case, all these lamps were fitted with cut-outs made of lead wire on the Edison plan, none of which were melted, although the current was probably one hundred per cent in excess of its proper strength. If sensitive fuses had been adopted the lamps would have been uninjured, and the consequent loss of 4s × 50, or 10*l*, would have been saved at the cost of the fuses which could have been replaced for as many pence. The interesting report of the life of the electric lamps at the Royal Courts of Justice shows that the average life of lamps burned out, which was 1,631 hours, was reduced to an actual average, after deducting losses, of 1,370, nearly the whole of which must be put down to the weakening of the filament due to an excess current having been passed, as the authorities, to guard against the extinction of a lamp here and there, have replaced the original sensitive fuses by others which only act in the event of a short circuit.

Before concluding this article, it may be interesting to note how some of the fires have occurred in America, where the insurance authorities have reported the electric light to be the cause. In one district of sixty-one miles, there were fifteen fires due to some form of "short circuit," generally due to leaking water or washing floors, all of which would have been prevented by proper insulation and reliable fusible cut-outs. Three fires occurred by short circuits termed "cross arcs" of one wire to another, where uninsulated wires were fastened against conductors. In one instance, the conductor was formed by dust settling upon uninsulated wires, and one damp day it absorbed enough moisture to form the path for the formation of a cross arc, which started a fire. In another instance, the wires were fastened to a damp beam, which was decayed, and burned nearly in two by a smouldering fire. In a third instance, damp brickwork in a tunnel was a sufficient conductor to establish an arc, which did not do any material damage there, but injured the dynamo. These fires were not necessarily destructive ones, as they generally occurred during working hours, and were soon discovered. Electricity, having no smell like gas to betray a leak, shows when it is escaping by the diminished appearance of the lights, caused by the diversion of the system.

The chief element of safety of electric light lies not only in the employment of experienced men to supervise the work of running the wires and arranging the installation, but in having the whole installation carefully tested and reported on by an expert who is independent both of the system employed and the contractor. When thus arranged, it is, in every situation, far safer than gas or any other known illuminant, especially when laid on to our houses from a central station, where any possible danger will be localized, and the whole of the machinery be under constant supervision.

In conclusion, no better proof can be stated as to the increased value put upon electric light by those who have had it installed than by quoting a recent case which came under my special notice, where an action was brought, by the Corporation of a large town, against the contractor for lighting the municipal buildings, who had refused to continue the supply of electricity. The pleadings stated that "the buildings in which the installation has been placed have been expensively decorated with a view of their being used with the electric light only, and these decorations, and also the books in the library, are suffering from the use of gas," — for the absence of the electric light the Corporation claimed heavy damages.

The following draft-form of specification of electrical conductors, leads, fittings, and safety appliances, is published with a view of showing some of the salient features of an installation which require

especial attention; the motive power, whether gas or steam, the dynamos, and the incandescent lamps should also each be the subject of a detailed specification: —

SPECIFICATION FOR CONDUCTORS, SWITCHES, AND APPARATUS FOR PROTECTION FROM FIRE.

Cables, leads, and wires are to be furnished capable of supplying current to —— arc-lamps and —— incandescent-lamps.

These conductors are to be laid and erected in the manner herein specified:

Conductivity.— The specified conductivity of the copper employed in the whole system of conductors to be not less than ninety-six per cent of pure copper.

Covering.— The wires to be covered in such a manner that the covering does not become frayed or loose.

Joints.— All joints are to be made of resin only, and not with killed spirits or any other flux. All wire ends, before joining, are to be properly cleaned, and the strands spliced in a thorough manner and well soldered together.

The joints, when made, are to be covered with a layer of Chatterton's compound, and properly and neatly wrapped with india-rubber tape, so as to leave a smooth surface. Britannia joints are to be used where solid conductors are joined together and are under tension.

Distance apart.— When conductors are run along walls or other exposed supports, their distance apart, from inside edge to inside edge, is not to be less than two inches.

Casings.— When conductors are placed in mouldings or grooved casings, the thickness of the material between each conductor to be not less than a one-fourth inch; and no screws or nails to be driven into this central rib.

Staples.— When conductors are stapled to a wall or other support, no one staple is ever to embrace both conductors, nor are two staples to be placed side by side, but are to be placed alternately.

Walls.— When conductors are carried through walls, or other partitions of a like nature, they are to be encased in asbestos or wooden (varnished inside) tubes of such diameter as to fit easily, but not too loosely. If carried on iron, such as rolled joists, they are to rest on asbestos, millboard, or on varnished wood. No wires to be carried through existing gas-pipes.

Insulation.— The total insulation of the whole system of conductors, when placed in position, to be not less than five hundred ohms resistance per volt of current.

Insulators.— When insulators are used they are to be of a type previously approved of by the consulting engineers.

Cleats.— Cleats are to be used for holding up the conductors in place when the size of such conductors is greater than a quarter of an inch diameter outside covering.

Capacity.—The capacity of the whole system of conductors to be such that the area of the conductor shall be equal to the area of one square inch for each one thousand ampères to be carried, or approximately one square millimètre for every ampère-and-a-half of current passing through it.

Dielectric.— No covering shall alone be employed for conductors that is capable of absorption of moisture, but india-rubber, gutta-percha, or some approved bituminous compound must always be used in conjunction therewith, and they shall be guaranteed to have an insulation resistance of —— megohms per one thousand yards.

Samples.— Samples of all cables, leads, and wires to be submitted to the Consulting Electrical Engineer for approval before commencing the execution of the contract, as well as all switches, cut-outs, and other materials.

SWITCHES.

Main Switch-board.— A main switch-board, with insulated back to be provided, with switches of the —— type and main cut-outs, which will allow of fusible mica foils being inserted, and arranged to control each separate circuit, and all connections to be made between them and the dynamos. A plan of this switch-board to be submitted.

Branch Switches.—Switches which cannot be left partly on, and which on breaking the circuit show no spark on the working-contacts, are to be provided, and all connections made thereto. They are to be firmly fixed to the walls or supports by screws upon a plug of wood driven into the wall, and are to be of ample size, and best material and workmanship. Rubbing contacts are to be used, and no switch is to contain a cut-out or safety-plug.

MAIN CUT-OUTS, OR FUSIBLE SAFETY-JUNCTIONS.

These are to be of the duplex fusible type, to carry mica foils, which shall give way whenever the current passing through them exceeds the normal working-current by fifty per cent. Each cut-out shall be fitted with a spare mica foil, through which a portion of the current always passes, and be of sufficient strength to pass the whole of the current on the melting of the ordinary working fuse, but shall give way in the event of a short circuit.

Branch Cut-outs.— Branch cut-outs of a type, with protected terminals and eyelet mica foils, are to be provided and fixed firmly to the walls or supports where shown, and in no case are they to be placed between the switch and its lamps, but always as close to the main cable as possible.

Melting-point.— Every branch cut-out shall be so proportioned as to melt with an excess of current not more than twenty-five per cent above its nominal value.

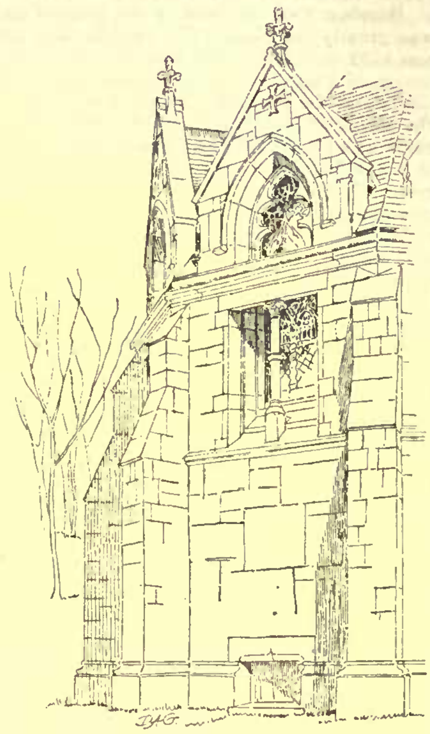
Switch and Cut-out Bases and Covers.—Where required, the beds of all switches and cut-outs to be made of slate or other non-combustible material.

If mica foils are not used, the cut-out to be suitably covered, to prevent any metal being scattered when fused.

Testing.— Samples of all the various sizes of cut-outs to be submitted to the Consulting Engineer for test purposes.

Damages.— Every care is to be taken to avoid all damage to existing fittings, and to all walls, cornices, floorings, woodwork, etc., and the contractor is to make good all cutting-away necessary for the fixing of the above cables, leads, wires, switches, cut-outs, etc., and shall leave the whole work in a neat, workman-like condition.

THE PALACE OF CHANTILLY.



One Bay of Apse.—Mortuary Chapel,—Forest Hills Cemetery Boston Mass. Van Brunt & Howe Architects

A WRITER in the *London Pall-Mall Gazette* says:

Whatever may be the political indiscretions of the Orleans princess, all lovers of art must sympathize with the Duc d'Aumale, compelled to leave his beautiful, his unrivalled creation of Chantilly. It is now about twelve years since the heir of Condés commenced the erection of a palace worthy to replace the historic residence of his great ancestors. Since the war of 1870–71 has arisen on the banks of the Nonette one of the most beautiful modern châteaux to be found throughout France, and here have been arranged with perfect taste the Duke's unrivalled collection of works of art. The English guide-books are in a muddle about Chantilly — I speak here not of the charming little town, but of the Duc d'Aumale's residence only. We read and are no wiser than before as to how much of the château remains. The truth of the matter is that, excepting the renowned stables and the exquisite little building of the *châtelet*, all is new and all is the work of the Duc d'Aumale. He has been, if not exactly his own architect, the leading spirit throughout the vast undertaking, not only entering into every detail without, but also arranging the interior of the building, erected as far as was possible on the foundations of the Chantilly immortalized in the pages of Mme. de Sévigné and of Bossuet, the seat of the Condés and Montmorencys. No *chef d'œuvre* of the architect's skill had ever more graceful surroundings. The château, with turrets and pinnacles, copy of the elegant architecture of the Valois period, stands sideways on the canal watered by the Nonette, and on clear days we get delicious effects of light and shadow, a reflected palace as lovely as the more solid reality. In front and behind stretch the quaint old gardens, laid out by the famous Le Nôtre in the time of Louis XIV, marble terraces, orangeries, fountains and statuary in perfect keeping with the gleaming whiteness of the building, itself apparently of marble. Oddly enough, the mind of the much-travelled beholder has to go to the distant shores of the Baltic for a parallel to this spectacle. In the heart of the picturesque little island of Rugen rises the famous palace of Prince Putbus, and it is this that will best bear comparison to Chantilly, if indeed comparisons are possible. Just as dainty a picture as the Italian palace reflected in its crystal lake, just as stately and elegant the terraced gardens and marble fountains, while alike the home of the Pomeranean Prince and that of the Duc d'Aumale is a choice treasure-house of art.

But the historic interest of the last is wanting at Putbus. The similitude holds good with regard to matters picturesque and artistic only. Chantilly is intimately connected with some of the most dazzling pages in French history. To have its chronicles at one's fingerends is to be intimate with a goodly chapter of the history of France. Everybody has read Mme. de Sévigné; everybody knows of the splendid entertainment given by the great Condé to Louis XIV, when Vatel, the cook, ran himself through with his sword because the fish did not arrive in time for dinner. But Chantilly had been a little court under the greatest of the Montmorencys a century and a half before. Here Anne de Montmorency, constable of France, the patron of the fine arts, but, alas! the pitiless foe of Protestantism, held his state when his fortunes were at their apogee, and for five generations Chantilly belonged to that great house. A statue of the fierce old warrior is in course of erection in front of the château. Just as the Duc d'Aumale is the creator of the Chantilly we see, so his ancestor may be said to have created the Chantilly of his own day. But between the two periods have occurred many demolitions and reconstructions, and only isolated portions remain to tell us what the respective homes of the Montmorencys and Condés were like. Thus in the beautiful *châtelet*, or *petit château*, on which the present façade is built, we have intact a perfect specimen of the graceful architecture of the Valois period, while the magnificent stables, in appearance looking like a palace, date from the eighteenth century only.

The Chantilly of the great Condé, Mme. de Sévingé, of Bossuet, of Louis XIV and his Court has disappeared altogether. The guide-books state erroneously that Chantilly was destroyed by the revolutionary mob. The truth of the matter is this: When in 1789 the Princes of the House of Bourbon took the lead in the general emigration, the populace was greatly incensed. The château was converted into a prison from 1792 to 1794, but it was the Convention that decreed the destruction of Chantilly on the ground that it was a fortress. The *petit château* and the Pavilion d'Enghein were spared and restored intact to the House of Bourbon Condé in 1816.

The history of Chantilly as a seignorial residence goes back to a very early period, but it is the Montmorencys who have endowed it with such historic interest. To the great Anne we are indebted for the priceless art treasures now contained in the chapel, the exquisite series of portraits on glass, the marvellously beautiful altar-piece, and the panels in carved wood — all *chefs d'œuvre* of the Rennaissance. In 1875, as we have said, the Duc d'Aumale began the erection of the modern château on the foundation of the old and now complete one. A brilliant soldier, an accomplished writer, art collector and bibliophile, he was enabled, thanks to the generous indulgence of the French Government, to remove his household gods from the banks of the Thames to those of the Nonette. Enlisting into his service skilled artists and artisans, he forthwith erected at enormous cost a Chantilly as splendid as that described by Bossuet and Mme. de Sévingé. The great charm of the place is the purity of taste displayed throughout, and the subservience of parts of the whole. The design was planned with the utmost care, and as far as possible the plan of the former building was adhered to. Hither have been brought the famous collections from Twickenham, the pictures, works of art, and magnificent library, and as being added to from time to time, Chantilly promised to become one of the most splendid residences in Europe. Quite lately the Duke acquired for £25,000 — a bagatelle to a man of his colossal wealth — the Earl of Dudley's famous Raphaels. Besides a historic portrait gallery of great interest, the great masters of Italy and the various schools of French art are here worthily represented. The Poussins, the Ingres, the Greuez, the Delacroix, the Décamps, form a collection worth making a pilgrimage to see. Then there are Raphaels, Da Vincis, Titiens — in fine, the Duke has not only been one of the most assiduous, but one of the most fortunate collectors in this world. There are also magnificent Beauvais and Gobelins tapestry, faïence, miniatures, marqueterie, engraved gems and jewelry, enamels, plate — not an art is there but is here represented, and in the choicest period. The library is in itself a museum, containing rare old editions in choicest bindings, alike ancient and modern. The arrangement is very elegant and convenient, the upper shelves being reached by light galleries.

Choice as are the art treasures of the Duke's own collecting, and splendid as is the accommodation provided for them, it is in the heirlooms of the Montmorencys that the historic interest of Chantilly culminates. An elegant little chapel has been built inside the château, and here, in a very small compass, we may learn, if anywhere, what French art was like under the Valois.

The two windows of old stained glass are in reality a series of family portraits, hence their interest and importance. Here is the terrible Anne — never man with woman's name less endowed with womanly tenderness! — with his four sons, in company of John the Baptist, all piously kneeling, while in the window opposite are portrayed Madeline of Savoy, his wife, with four of her daughters, having for saintly company St. Agatha. The entire family of this pair numbered twelve. By a freak of fortune the foremost figure of these historic groups was deprived of his head. For the portrait of the Constable, which has been supplied, we are indebted to the other numerous likenesses in existence. There is notably the famous medallion in wax at the Louvre, and the still more famous enamel of Léonard Limovsin. Anne de Montmorency also figured as the god Mars in the celebrated enamel, after Raphael, of the same artist, "Le Banquet des Dieux," which formed part of the Fountaine collection, and lately fetched 7,000 guineas. The delicacy and finish of these portraits are remarkable, and every detail of costume is given with the most minute exactness. The altar-piece is an elaborate work carved out of fine-grained limestone and ornamented with delicate bas-reliefs; to Jean Buliant is attributed the former, to Jean Goujon the latter. Both stained-glass and altar-piece were originally at Ecouen, also an appanage of the Montmorencys. The series of panels in stained wood which adorn the sides of the chapel are equally interesting, and have fortunately been preserved intact. The Constable was a friend of the worthless Valois King Henry II, and highly suggestive of the morality of the epoch are the emblems of Diane de Poitiers, the king's mistress, found so frequently here, bow and arrows and a crescent. The date, 1548, is inscribed in one of the panels. The subject is the lives of the Apostles. We are reminded by these exquisite panels of the perfection to which the decorative arts had attained under the Valois régime — some compensation for political and social immorality hardly outdone in the pages of history. The truth of the matter is that during the sixteenth century, in every branch of the decorative arts, France reigned supreme. What variety, what w alth, what taste were seen in every object then constituting luxury, furniture, ornament, dress! What technical skill, what purity of design, what wealth of imagination abounded! Here, then, for a few brief years the heir of the Condés has held his state; and here without doubt he might have remained but for dynastic intrigue and indiscreet ambition on the part of his family. It is impossible for any one intimate with French history as it is being enacted under our eyes to ignore the above fact or to feel the least surprised at the step being taken by the French Government in the matter of the Pretenders. My only wonder is that the expulsion has not taken place long ago. For the Duc D'Aumale, elderly, a widower and childless, thus compelled to remove his carefully amassed treasures, much sympathy will be felt, but entirely of a personal and artistic kind. The Republic behaved at least as generously as could have been expected. It restored to the Orleans Princes the millions confiscated by Napoleon III, it permitted all members of the family to settle themselves in France and enjoy the privileges of other citizens. When this generosity was abused, the government of France had no other recourse but to resort to drastic measures.

COMMUNICATIONS

[*We cannot pay attention to the demands of correspondents who forget to give their names and addresses as guaranty of good faith.*]

THE EFFLORESCENCE ON BRICKWORK.

BROOKLYN, N. Y., July 1, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I write to ask if you know of any way of treating new brick fronts by which the white efflorescence may be removed and permanently prevented from again appearing. I am told by one of your subscribers he thinks you have already made public such information, but I have not been able to find it. Have been seeking instruction on the subject for some time past; have read a great many learned articles on its causes and composition, and am in a maze of sulphate crystals, magnesia, silica, etc., etc., but not a ray of light as to its cure.

If you can dispel my darkness in any way it will be gratefully acknowledged by Yours truly, J. W. ROWE.

[YOU will find a satisfactory explanation of the cause of the effect and the remedies that can be applied in the issues of the *Ameri an Architect* for November 1 and December 6, 1884 — EDS. AMERICAN ARCHITECT.]

ADVICE TO A STUDENT WHO HAS $1,000 TO SPEND.

AKRON, OHIO, July 5, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you kindly state, through the columns of your journal, or by letter, what you consider the best course for a young man to pursue, or the best place for him to g to obtain proper training in architectural design and construction. The profession, even in the West, has now so developed that one cannot serve a year or two in an office and then hang out his shingle a full fledged "architect" as of old.

After six months' work here, coming fresh from college, I thought I knew it all, but now, three years later, it seems that I have only learned to know that I know nothing.

With a thousand dollars at command, what shall I do?

Perhaps, as a young draughtsman asking your opinion, I voice the desire of many ‹ thers of your readers.

Respectfully yours, GEO. A. NEWCOMB.

[THE fact that our correspondent has learned that he knows nothing of architecture after three years of office-work disposes us to think that he really knows more than he thinks he does, and in place of advising him, as we should in most other cases, to enter some regular school of architecture, preferably the Ecole des Beaux-Arts, we think it safe to recommend him to use the greatest portion of his thousand dollars for an economical trip to Europe. If, after seeing England, Scotland and the South and North of France—more than this would be mere luxury — he can so arrange things as to spend three months or so in a Paris *atelier*, and can use the time in making studies, after the school programmes, carrying each one through the preliminary stages only, that is, spending not more that a week or ten days on each, we believe he would get as much benefit from the *patron*'s criticism as if he spent a year in elaborating the designs after the usual method. If he is not sufficiently proficient in French to do this to advantage, we recommend that he should come back to Boston before his money is all spent and pass the same length of time in doing the same thing under the advice of Prof. Létang of the Institute of Technology. It would be well to set aside a small sum to be used in the purchase of photographs and books which can be bought to better advantage on the other side of the ocean than they can here.— EDS. AMERICAN ARCHITECT.]

THE ALBANY CAPITOL FOR ONE DOLLAR. — A dispatch to the New York *Times* announces that the Capitol at Albany is advertised to be sold September 15. It seems that the county treasurer has a charge against the building for a water-tax of $1 and proposes to sell it with other delinquent property. To the original amount due $2 have been added for advertising, 50 cents for auctioneer's fees and sundries sufficient to make up the sum of $3.74. It is suggested by the *Times* that some New York paper should undertake the task of raising money to pay off this indebtedness and free the new Capitol from danger. We protest against any such meddling. If there be any process of law by which the great public calamity can be sold and pass out of the hands of the State, then let the law take its course by all means. The building has cost, in round numbers, $17,500,000, and might be worth $500,000 to private parties; but the State would be well rid of it for a debt of $3 74. By all means let the treasurer of Albany County go on with the sale.— *Rochester Post-Express.*

NOTES AND CLIPPINGS

A Useless Long-range Gun.—Prince Lichtenstein was formerly well-known in London, and his first wife was Miss Fox, the adopted daughter of Lady Holland. He some time ago purchased a Krupp gun of large calibre, which he intended to mount in one of the fortresses of his dominions. When the officer commanding the Lichtenstein artillery attempted to make arrangements for an experimental trial of the monster piece of ordnance, it became evident that it would be impossible to avoid firing the projectile into somebody else's territory, which would have been probably regarded as an act of war, and would have invited reprisals. The gun being thus perfectly useless, it was by order of the Prince converted into an equestrian statue of his Serene Highness, which now adorns the public square in his capitol.—*London Figaro.*

The Sonnblick Observatory.—What will be the highest observatory in Europe is now being erected on the Sonnblick, in the Tyrolese Alps, a mountain 10,000 feet high. Some mines are situate on the slopes of the Sonnblick at a height of over 5,000 feet. From this spot a wire ropeway, practicable for passengers, leads up to a height of nearly 8,000 feet. Here a house has been erected for miners, who reside there during winter. Thence the summit of the Sonnblick is reached by an easy ascent over a glacier in three hours. The observatory now being erected on the summit will consist of a block-house, flanked by a massive stone turret 40 feet high. The walls of the tower have been made of an enormous thickness, and the block-house is anchored to the rock by steel-wire cables. Wood has been chosen for the construction of the house, because it keeps out cold better than stone. The tower will be fitted with all the instruments used in meteorological science. As there is great danger to the building from the terrific thunder-storms which rage round the summit, the observatory is protected not only by three lightning rods, but also by a lightning-proof fencing. The solitary resident observer is one of the miners, who is now undergoing a course of instruction in meteorology. He will keep up communication by telephone with the miners' house, 2,000 feet below him, whence another telephone wire, 15 miles long, leads to Rauris. From the latter place his daily record of observations will be telegraphed to Vienna. Sonnblick Observatory will be known in future as a meteorological station situate at a higher elevation than any in Europe—higher than those on Mount Etna, the Pic du Midi (Pyrenees), and the Säntis (Canton of Appenzell. —*Engineering.*

A Tunnel to Prince Edward Island.—A scheme for constructing a tunnel to connect Prince Edward Island with the mainland is to be brought before the Canadian Parliament next session. It is proposed to build on each side of the straits piers through which a tube is to be driven for some 2,800 feet, the total length of the tunnel being 6½ miles. The bottom of the straits shows a very good road-bed, the depth of water varying from 36 feet on the island side to about 80 feet in the middle of the straits, and thence ashore on the New Brunswick side to 10½ feet. The tunnel is to be 18 feet in diameter, and to be constructed of heavy sections of chilled white cast-iron, 4 inches thick or more, according to depth. Mr. H. H Hall, of the Submarine Tunnel and Tube Company, of New York, is the patentee of the process of casting the tubes, as well as of the chilled white metal used. It is estimated that, at the present market price, the cost of the iron for the tunnel would be about 17*l.* per linear foot, making the total estimated cost of the work close upon 1,000,000*l.* The metal is stated to be non-corrosive in sea water, as shown by its exposure for twelve years in the harbor of Sydney. The sections are bolted together by inside flanges, making a water-tight rust-joint with a smooth exterior. A connection with the surface could be maintained by a vertical shaft, if desired; but as a railway could be laid through the tunnel as fast as it is built, all the material used could enter that way, a supply of fresh air be obtained, and communication maintained with the shore. Where the depth of water will allow of the obstruction to the channel, the tunnel is to be laid on the natural bottom of the strait; otherwise a channel is to be dredged, in which the tube is to be sunk.—*Engineering.*

The Age of Trees.—The Prussian Chief Forester Gericke, in a recent number of the *Fortliche Blatter*, declares it to be a fable that there are trees in the German forests which have lived for a thousand years. Even the so-called "historical trees," he says, to which an age of 700 to 800 years is imputed, are nothing but "hollows surrounded with bark, vegetating only as ruins." No tree can reach so great an age in Central Europe and remain healthy. He has been at the pains to make inquiries at all the German, Austrian and Russian forest academies; and comparing their reports with his own long researches, he has compiled a table of the comparative ages of the different sorts of trees in Central Europe. The highest age is attained by the pine; but after it has reached the limit of sound life, it declines more rapidly than any of the leaf trees, which continue vegetation long after they have begun to decay. The oldest pine tree, judging by its annual rings, reaches an age of 570 years. The next in age, the white fir of the Bohmerwald, is 429 years old. The larch, in Bavaria, was at its oldest in 274 years. The oldest sound oak, which is at Ascheffenburg, is 410 years of age. The oldest red beech, also at Aschaffenburg, is 245. The highest point of healthy age with other leaf trees is as follows: The mountain maple, in Bavaria, 224 years; the birch, 160 to 200 years, in Finland; the ash, 170 years, in Silesia; the elm, 130 years, in Silesia; the aspen tree, 219 years. The most frequent among the so-called "historical trees" in Germany are lime trees (linden). The renowned Linden of Neustadt-on-the-Kocher, in Wurtemburg, is known by the local chronicle to have had its branches supported by 67 strong staves in the year 1448, so that it must even then have been a venerable tree. It has now seven horizontal branches, which are supported at from 5 to 7 feet from the ground by stone columns. It is reputed to be over 700 years old, but it can hardly be said to be alive; it is quite hollow, and is supported by internal as well as external masonry.

TRADE SURVEYS

The encouraging feature in this week's trade review is to be found in the instructions to manufacturers of all kinds of building material to hasten forward deliveries on the contracts placed during the second quarter of the year. Iron and steel makers, lumber dealers and manufacturers, dealers in saw-mill and planing-mill products, in builders' hardware and in all other branches, have, within a few days, been requested to complete deliveries of considerable quantities of material which is wanted for immediate building purposes. It is ascertained that it is the intention to push building operations very actively this month and next. Besides this, very active work has been begun on railroad building in the West and South. Work on public buildings all over the country is also being pushed rapidly forward. Some few architects and builders, whose opinions have been asked for, state that the possibility exists that the spurt in building may set in late in the season. This may take place. It is ascertained that a great deal of work that was thought of, if not really projected early in the year, has not yet been undertaken, and that it is being held back for one reason or another, or perhaps for no reason at all. The prudent builders are therefore anxious to complete work in hand in order to be ready for emergencies. Real estate operations have been prosecuted with a great deal of activity through several New England States and in New York. According to trade statistics, it appears that a much larger amount of work has been done this year than last, and if the present rate of progress continues, the figures will be fifty per cent in excess of last year. Philadelphia is way ahead. Pittsburgh is quite active. In Cincinnati, Cleveland, Columbus, and in three or four smaller Ohio towns, a great deal of work is being done in shop, mill and house building. In Chicago the builders have survived the check given to enterprise, and are now very busily at work. The same is true in Milwaukee, Springfield and St. Louis. Cities west of the Mississippi are also picking up, and iron, nails, steel, lumber and builders' hardware are being forwarded freely from Chicago and St. Louis to builders and dealers. The iron trade just at this time is rather dull. The pig-iron production, however, has reached its highest-known point of 121,000 tons per week, which is something over 6,000,000 tons per year. Prices are very firm and the trade outlook is said to be gratifying for all kinds of material, particularly for merchant steel, steel rails, old rails and pipe iron. The greatest demand prevails for skelp-iron and wrought-iron pipe in Western Pennsylvania and Ohio. The bridge works are also full of orders for the present, and it is believed that the coming autumn will be a very active one with bridge-builders, as it assuredly will be with railroad builders. So far this season about 1,800 miles of main track and sidings have been constructed, which leaves in the neighborhood of 5,000 miles of projected road yet to be built. Railroad labor is in active demand, and material is being called for from mills, car-works, bridge-works and locomotive-works. A few contracts for locomotives were placed a few days ago, and the car-builders have also been requested to submit figures for desired work on freight, passenger, coal and cattle cars. The demand for lumber is reported as rather moderate, but it simply means that contracts for future delivery are not being placed at present writing. It is known, however, that the requirements are heavy and that the entire lumber capacity will be kept quite busy on contract work. The Western architects furnish a few encouraging points this week concerning contract work, and the builders of small houses and shops also are reported as quite busy with new work. The supply of money for reproductive operations is abundant. Clearing-house returns show an increase as compared with previous weeks and as compared with the same weeks last season. The dry statistical returns furnish very encouraging and instructive lessons and mean simply that the country is gaining in consumptive capacity and therefore in productive. Within a week or two the makers of special machinery for mills, mining, and large manufacturing purposes have booked a number of fresh orders. Textile manufacturers have also ordered liberally within a few days, and agents of large textile machinery manufacturing establishments are now about closing contracts, which will make work at the shops more abundant than at any time within eighteen months. The supply of building material, such as laths, shingles, nails, hardware, cement, etc., is equal to the demand, but not beyond that. Prices are preserved at spring quotations with a few exceptions. No matter in what industrial channel an observation is taken, it is found that this year's production is greater than last; that prices are steadier and that the productive demand is more encouraging. Traffic between the Northern and Southern States is also on the increase. The manufacturers in the South have been greatly encouraged by the demand and prices of the past six months, and it is apparent that the encouragement that has been extended will be followed up by additional investments on a large scale. English capitalists are looking very carefully into Southern opportunities. New plants are being projected and constructed in Tennessee and Alabama. Four or five blast-furnaces are to be built, two rolling-mills, several manufacturing establishments; besides coke-ovens are to be built, and machine-shop capacity for supplying railroad requirements is to be provided at several points. This broadening out is an encouraging feature to manufacturers throughout the New England and Middle States. The same spirit of enterprise is extending into the West, and prominent lumber dealers in Chicago and in the Northwest report through their travelling agents that they have excellent prospects for placing large supplies of lumber during the coming three or four months. Nails are quoted at $1.80 to $2 at mill in New York and Pennsylvania; merchant iron at one and one-half to two cents per pound; muck bars $27; forge iron $15 to $16 50; foundry iron $17 to $20, according to quality. Several large Pennsylvania companies are sold three months ahead even now. All the rail-mills, wrought-iron pipe mills and skelp mills are well supplied with business and will be run with orders three months ahead to the end of the year. Steel rails are selling at $34 to $36; iron rails $19 to $20. Lumber has not changed in prices for good quality for several weeks. Discounts on hardware and barbed wire and on carriage and wagon material have not been shaded although the demand for the past sixty days has tempted some makers to break combination rates. There is still a tendency among manufacturers to combine to preserve the present low prices against the possibility of secret cutting. The anthracite coal trade is weak. The vessel owners are concerned over the competition of outside tonnage, which refuses to be bounded by the rates they have established, but at a meeting held recently at Philadelphia the Association decided not to reduce rates, but wait for its share of business, until after a revival of trade, which it thinks will set in before the close of the month. The striking spirit has almost subsided. At the same time there are rumblings among the laborers of the country because of the conservative course announced by their leaders, with reference to striking and boycotting The unadulterated purpose of organized labor is to strike, but under the conservative management of the leaders this purpose has been set aside. It remains to be seen whether the organized workmen of the country will accept the advice and policy of their leaders and submit all disputes to arbitration.



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CONTENTS

THE demand for back numbers of the *American Architect* has been so unequal that of certain issues we have few or none left, while of others we still have many. For the sake of evening-off our remaining stock, and gaining space in our stock-room, we have decided to offer a large number of miscellaneous issues, published from 1880 to 1885, at less than manufacturing cost, and interested readers are referred to our advertising columns for fuller particulars. Architects and draughtsmen are so much in the habit of assorting into distinct classes the architectural illustrations that come to them that we think that not a few of them, even those who have complete bound sets of the *American Architect*, may be glad to have so much valuable scrap-book material offered them at a moderate price.

WE learn from the Providence daily papers that it is apparently as far as ever from being settled what method of disposing of the city's sewage shall be adopted, and if the *Journal* of that city is looked up to as a leader in this movement, as it justly is in many another, we fear that the authorities are likely to make a mistake through unnecessarily magnifying the probable amount of sewage which the new works may be called upon to treat. It seems to us most unwise to hold up as the type of what it is desirable to do the costly and unsuccessful Metropolitan Sewage System of London, with its huge intercepting sewers and outfall works. It seems as if a small place like Providence would do better to copy some of the systems of sewage disposal which are in successful operation in towns of about its own size, rather than to seek a model in the works of the world's metropolis. Dantzic, for instance, which is one of the places which has carried on successful sewage-farming operations for the longest time, is a town of about the size of Providence, and its sewage is successfully disposed of on a sandy tract of about four hundred acres, while Providence has in the Seekonk Plains about one thousand acres of similar land within easy reach.

ON looking over the list of the Acts and Resolves adopted by the late Massachusetts Legislature, we find that it would have been better not to have readjusted at the last moment what we wrote about the proposed office of fire-marshal for the City of Boston so as to read that the measure was defeated; apparently we misunderstood the report of the legislative proceedings read hastily in the cars as we came to town, for we now find that the law was enacted, subject to the adoption of the Boston City Government. In the paragraph we now correct, we spoke of the difficulty of determining what are incendiary fires, and said that one of the chief reasons why so many fires were reported as arising from unknown causes was that careless employés lacked the moral courage to acknowledge their own negligence. In support of this conjecture comes the confession of the unfortunate man who brought about the destruction of the great exhibition building in Boston a few weeks ago, and which at the time was attributed to incendiaries instigated by the Knights of Labor. It seems that this man was employed temporarily in a small room in the front of the building apart from all the other hands, and having occasion to use his glue-pot lighted it and went to the other end of the building for some tools, leaving no one to watch over its actions; during his absence the apparatus got over-heated and as he entered the room again the naphtha or oil boiled over; catching it up he tried to throw the lamp out of the window, but was prevented by the wire netting, and before he could take it out of the door he was obliged to drop the blazing thing among the shavings and other litter that usually cover the floor of a carpenter's shop. It is rather remarkable that the poor fellow found himself able at length to acknowledge that to his thoughtlessness was due the death of several of his fellow-workmen.

A USEFUL career was brought to a close last week by the death of William Ripley Nichols at Hamburg, Germany. To the members of the profession in Boston, at least, and to sanitarians throughout the country, Professor Nichols was well known, chiefly as an expert in the matter of water analysis and, later in his career, on water-supply; and his papers on these subjects published in the reports of the Massachusetts State Board of Health, and in various technical publications, as well as his book on "water-supply, considered from a chemical and sanitary standpoint," are too valuable to be neglected by any one who finds it necessary to post himself on that, perhaps, most important matter of all that affect our daily lives — the ways and means of procuring an adequate supply of pure water, whether for a country house or for a city. Professor Nichols was a young man, and one of the earliest graduates from the Massachusetts Institute of Technology at Boston, by the corporation of which, soon after graduation, he was invited to take the chair of professor of general chemistry, a position which he held to the satisfaction of the authorities and the students as well until his death at the age of thirty-nine.

WE believe that this country can boast — if it is thought worth while to do so — of a relatively greater number of equestrian statues than most other countries. Still it does not fall to every American sculptor who has had the chance of modelling one equestrian statue to receive a commission for another. The late Henry Kirke Brown, a sculptor of the elder school of American sculptors, had this chance, and, in both cases, succeeded in pleasing the public, and escaping the severe censure of the critics. Neither his Washington in Madison Square, New York, nor his General Scott at Washington can be called great and unqualified successes, but they are at least unobjectionable and are better worth what they cost than the majority of our public statues. Mr. Brown, who was born in Massachusetts in 1814, was one of those fortunate beings who, from their early years, are conscious of a real inclination to pursue a certain career in life, and not only that, but who have a sufficient force of character to enable them to achieve their aim in the face of opposing conditions. At the early age of twelve, Mr. Brown painted his first portrait, and half a dozen years later came to Boston to study the art of portrait painting, but almost immediately turned his attention to sculpture. In course of time, finding that New England did not afford the opportunities he desired, or the congenial atmosphere he longed to be surrounded by, he made up his mind that he must prosecute his studies in Italy. For such a step he lacked the money, so for several years he devoted himself to railroad engineering in Illinois, and at length was enabled to spend four years in Italy. On his return to this country, he turned his attention to bronze casting, and is said to have cast the first American bronze statue. Among the bronze statues we owe to him are the two mentioned above, statues of Lincoln in New York and Brooklyn — which we could do without — and a statue of De Witt Clinton. His works in marble include the statue of General Nathaniel Greene at Washington, certain sculptured figures over the main entrance of the Capitol, and several imaginative figures and groups.

TURN about is fair play, and so much damage has been done to houses and other buildings by the running of telegraph lines over them and the erection of telegraph standards upon them that it is rather refreshing to read of a house at length wreaking revenge on the telegraph, telephone, and electric-light companies. It seems that in Jersey City a house was being moved through the streets, and the contractor in charge, thinking that a telegraph-pole would offer the same amount of resistance as a tree having the same diameter, made his moving tackle fast to one. As soon as the strain was brought on the pole it snapped off and brought with it to the ground all the wires it bore. One of the consequences of the accident was serious: the snapping of the electric-light wire broke the circuit, but as the engine was still in motion the interrupted current generated so much heat that the armatures of the dynamo were destroyed, and a loss of over five thousand dollars was inflicted on the electric-light company, which, naturally enough, will seek to recover the loss from the contractor, for whose sake we will hope that Jersey City is one of the places which enacted laws that all electric wires should be put below ground before some passed date, as in such case the contractor could hardly have to pay for damage to property which has no legal standing above ground. We are a patient people and submit to much high-handed treatment at the hands of corporations, but if our inanimate chattels are at length animated with a spirit of revenge we may pick up courage and hope for an approaching millenium.

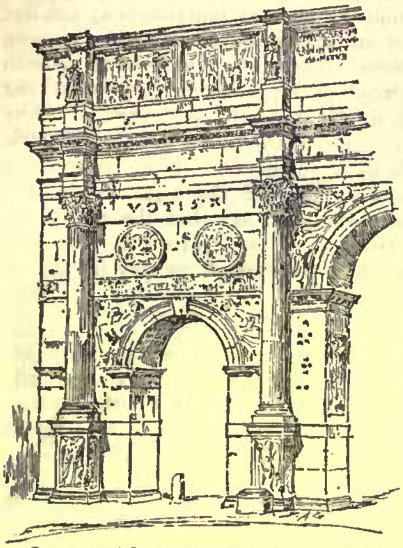
THE New York Electric Subway Commission having at length determined to do something seems to us disposed to do too much and to act too hastily; and, unfortunately, the haste it shows can bear the interpretation of a desire to get the contract for construction into the hands of a ring quite as much as a zealous interest to benefit the public. It has formulated some new resolves, and has already awarded the contract for constructing the conduits to the Consolidated Telegraph and Subway Company, subject to its being able to give bonds in half-a-million dollars for the proper execution of the work in satisfactory fulfilment of the conditions laid down by the Electric Subway Commission. As these conditions indicate at present a mere skeleton of the work to be done, it seems as if a company is either very unwise to give bonds in so large an amount to carry out imperfectly specified work, or else that it is conscious that it can induce the Subway Commission to "let up on it" when it comes to a pinch. As one of the "resolves" is that the electric companies shall not be charged for rental a sum in excess of the present cost of maintaining their wires overhead, the contracting construction company is furnished with one fixed factor for its calculations; but as it is still unknown what this cost is to each of the electric companies, and as they have until to-day to report how many ducts in the new conduits they are likely to need, which of course will have a bearing on the cost of construction, we do not quite see how it has been possible for the construction company to reach the conclusion that there will be any profit to it in the contract. Moreover, it is said that though it has acquired a number of patent-rights, there are other companies which unsuccessfully submitted proposals for the work owning other desirable patent-rights which stand ready with injunctions, which will be brought into use to stop or hinder operations at every opportunity. So, although there is talk that the entire work will be done within a year, it would not be surprising if the mere beginning should be made at an even more remote date.

APPARENTLY what the Electric Subway Commission has determined on is that the conduits shall be laid about eighteen inches below the pavement of the sidewalks, and that shallow junction-boxes shall be used instead of the deeper man-holes; that wires carrying intense currents, for arc-lights or motive power, shall be carried in a separate conduit, at a lower level; that the incandescent-light wires shall also have a separate conduit, while the telegraph, telephone, messenger, fire-alarm and other wires carrying currents of low tension shall be included in the main conduit; that the conduits are to be square in section and of such area that above Canal Street they shall contain twenty-four ducts of two and one-half inches diameter each, and that below that point they shall contain fifty similar ducts; that in sparsely-wired districts wires may be carried in tar-coated iron pipes; that house-connections are to be carried in iron pipes to the middle of each block, and that they are then to be joined with the connecting cables brought to that point in iron pipes from the nearest junction-box, smaller service-boxes being placed on this line to facilitate the making of more frequent connections; that the asphalt conduits are to be protected by mineral-wool packings where they pass near steam-heating pipes; and, finally, that all and every of these conditions is subject to revision at the hands of the Electric Subway Commission. To us it seems that if the contracting company has not an understanding with the Commission, it is assuming a great risk, and yet experts say that the profits are sure to be from fifteen to twenty-five per cent on the four million dollars which are thought to be enough to pay for the installation of the new system.

EVERY one may not know that the firemen of Paris are soldiers of the army, selected for the duty out of the ordinary corps, and formed into a regiment by themselves. The men composing this regiment, that of the *sapeurs-pompiers*, are required to be young, strong and active, and must have no family dependent upon them. Among the eligible candidates for the service those are chosen who have the best record for good conduct, and failure in their duty is punished by return to their former regiments. Counting the theatres and other points of special danger, where one or two firemen are kept regularly on duty, there are two hundred and two posts in Paris. Most of these are provided only with hose-carriages, but there are in the city eighteen steam fire-engines. According to *Le Génie Civil*, this number is much too small. There are forty-two in London, and the number of those in Paris would have been increased long ago, but for the expense of providing quarters for them. The instruction of the men is mainly carried on in the great barrack buildings, one of which has just been completed in the Rue de Chaligny, in the middle of the poor and combustible quarter of the Faubourg Saint-Antoine, while two others exist in other portions of Paris. The new building contains on the ground floor the fire-engines, divided into three sorts: the steam-machines, the hand-engines dragged by horses, and the hand-engines drawn by men, besides the hose-carriages, and room is found also for the office, bed-rooms for the barrack-master and the engineers, one or two instruction-rooms and a refectory, while a drill and exercise ground occupies the open space in the rear of the buildings. On the next story are more instruction-rooms and dormitories, besides a library, and an apartment for the sergeant-major, and the two upper stories are taken up by rooms for the officers. In the engine-rooms are stalls where the horses stand ready harnessed. In the furnace of the fire-engine the fuel is laid ready to light, and a steam-pump in the basement, heated by gas, and kept with steam always under pressure, is so arranged that the same telegraphic signal which rings the alarm drops a lever and starts the pump filling the boilers of the fire-engines, a work of thirty-four seconds. It is not very easy to see why the boilers should not be kept full of water, so as to save the time needed to fill them, but the operation is so rapid that in one minute from the striking of the signal the engine is ready to issue from the door, preceded by its hose-carriage. As in our fire-stations, the dormitory of each crew is over its own engine, and a trap-door and mast bring the men quickly to their places. If any man should be injured while on duty, a surgeon attached to the barrack is ready to attend him, and lectures, drills and exercises, carried on with exemplary thoroughness by the officers, keep the regiment in the best condition. As with us, alarms are given by telegraph from the small posts scattered through the city, but, the signal not being automatic, more information is conveyed by means of it than by our ordinary bell-signals, and the local operator nearest the fire calls immediately from the barrack belonging to his district such men and engines as he thinks will be needed.

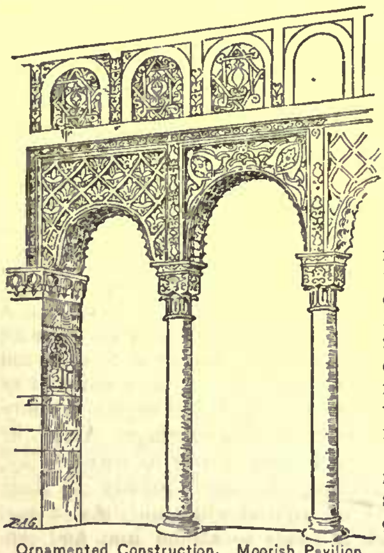
SOME time ago a sum of money was raised by subscription in France for the erection of a monument to the memory of Admiral Courbet. The matter has now gone so far that the execution of the work has been confided to the sculptors Falguière and Mercié with M. Paul Pujol as architect, and a petition signed by the principal subscribers to the monument fund, has been presented to the Municipal Council of Paris, praying for permission to place the monument in the centre of the square Montholon, an open space in the fashionable quarter at the end of the Rue de Trevise.

CONSTRUCTION THE ORIGIN OF ARCHITECTURAL DETAILS.[1]— I.



Constructed Ornament. Arch of Constantine.

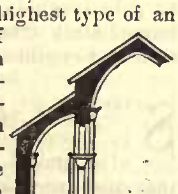
FERGUSSON, in his history of architecture, gives a description of the celebrated cloister of the Cathedral of Puy-en-Velay, in Burgundy, and makes a comparison of its style with certain well-known examples of Roman architecture. He says, "In the style of the Romans pillars were used as mere ornaments and were nothing but useless additions without even a pretense of utility." "It would be difficult to find" he adds, "an after illustration of Pugin's famous antithesis than this cloister of Burgundian architecture, and the Flavian Amphitheatre at Rome, or that at Verona — the one (Roman) is *constructed ornament*, the other (Burgundian) is ornamented or ornamental construction." There is no doubt whatever that the pillar is intended first for use as a support, and its introduction as a decoration or ornament is decidedly of secondary importance. But the Roman order of architecture was not an *original* order; it did not grow with them from earliest childhood — passing through stages of tentative design until it reached its maturity — the Romans had no order till they learned of the Greeks, and then they began on the foundations already laid, with examples of experience that had taken years to collect, ready to their hand, to design an order adapted to their own ideas, and the result was not particularly happy. The true spirit of art was not innate with them. With the early Greeks centuries of earnest study and careful striving after something better than they possessed, but which they felt was attainable by perseverance and study, resulted in the perfection of what we call the "Doric" and the "Ionic" orders, and would, no doubt, had time been allowed them, gone on even farther and enabled them to hand down to posterity a perfected "Corinthian" order of their own, which circumstances prevented them raising to the dignity of a "temple order." Then, again, the Greeks learned from others; their first ideas were brought from the East—from Egypt, that great mother of the world whose glory has long since passed away and whose place knows it no more. But with the Romans it was different; they, so to speak, had no past — no traditionary art of their own to improve upon and work out and study for themselves; they could but copy and adapt, by way of founding a style, in an art which was in itself entirely new to them.



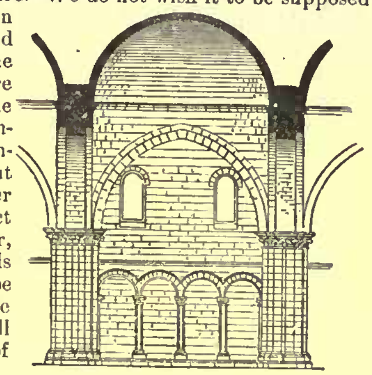
Ornamented Construction. Moorish Pavilion, Granada.

True architecture is ornamented or ornamental construction, and as the Romans *constructed* their ornament they failed, naturally enough, to grasp the spirit of the art.

The earliest examples in which art is connected with sheer manual labor cannot, in the strict sense of the word, be called "constructional." The marvellous excavations of the Shepherd Kings which, in their extent and immensity, are as wonderful in their way as some of the greatest constructive works of later centuries, were all decorated with the greatest care and ingenuity, in the highest type of an art then in its infancy — but although the spirit of the rule of true architecture admits of expansion and adaptation without loss of its force and significance, we wish for the purposes of this paper to confine ourselves to the periods of construction in which art is fully known and recognized, that we may consider and illustrate the truth of this golden rule. The application is as fit to all works now as it was in the Middle Ages to the works then carried out; and more than this, we cannot have true architecture unless we are united with this spirit and carry it out to the letter. The consideration of the smallest detail is of great importance in design; we must have the right thing in the right place—the very thing that is needed in the very best proportion, according to the position it is to occupy—neither insignificant nor overwhelming, neither such as to attract particular attention to itself, nor such as to be lost or buried by its surroundings, but so that it may add its quota to make a perfect whole, so that the effect may be homogeneous, and that a sublime expression of repose may pervade the whole structure. We do not wish it to be supposed from this that every detail in the first instance should be pored over and made a burden to the soul of the designer; if such were the case the whole would run the risk of being swamped by its component parts—but when the general idea has been thought out and perhaps committed to paper in a sketchy form, it is the effect of the whole which we consider, and afterwards come the details — then it is that these must be considered, in relation to the general effect, or the result will very likely be the opposite of that at first intended.

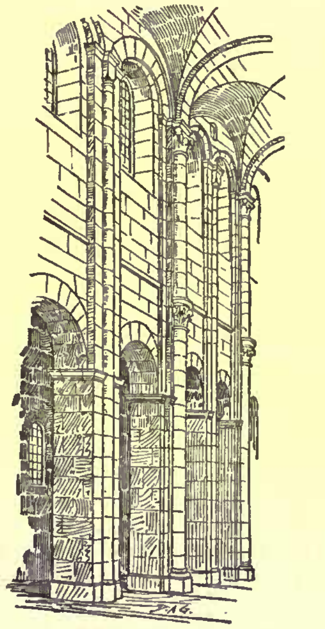


Fontifroide, Provence.

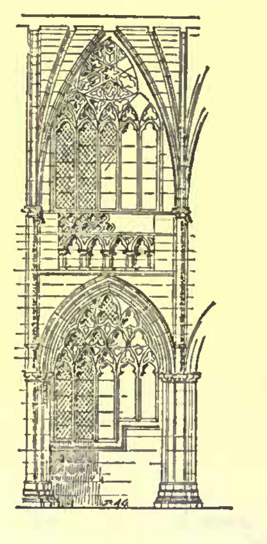


Section, Fontevrault. A. D. 1125.

Now, architecture being ornamental construction, it goes without saying that construction comes first into the question: that is, certain rules must be observed whereby stability and security may be obtained in the simplest manner compatible with the objects in view. If strength only is the object, the same *result* may be obtained in various ways, more or less clumsy, or else in the one way in which the least material is used, but in which each separate particle is made use of to its utmost ability and made to exercise its dumb energy to the fullest extent, that there may be neither waste of stuff or undue occupation of space. Suppose, for example, we want to resist or counteract the thrust of a stone vault, there is no limit to which we might not go to obtain sufficient strength in our abutments; so long as we have enough bulk or mass, perhaps it does not matter how much we are in excess of actual necessity. But where is the beauty of the science which teaches us to use what is necessary and no more, to make each part do its own duty and no more, and to make it do its duty to the full extent of its powers at the same time not overstraining it nor requiring it to do too much. At the present moment we are not taking into consideration the mundane question of cost, we will deal with examples from old works which have taken fifties and hundreds of years to erect, and of which the cost was of no account, but at the same time we wish to show that even in these



Spires Cathedral.



Exeter Nave.

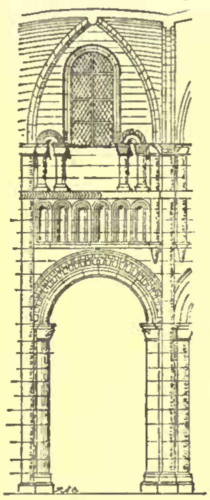
days the principle of design is the same throughout — although surroundings and circumstances may change, the *principle* cannot, but remain as the life-blood, the very marrow of art for time and for eternity. We have, in a former paper, given a sketch of the birth, growth and ultimate perfection reached in the science of vaulting, but it will be to our advantage on the present occasion to turn our attention to this, the greatest problem of Mediæval builders, and see what result was obtained by long years of patient experiment. Generation after generation of the guild of masons added each its mite to the store of information; great souls were striving after the accomplishment of a great fact, which was felt to exist, but which as yet was beyond their power to grasp. Provinces and whole nations entered into the task, but not until nearly a thousand years had passed was the principle discovered and the grand object obtained.

Take, for example, some of the earliest churches; they were nearly all finished with vaulting of the simplest form, with the springer so far down the walls that very little space was left for windows,

[1] By R. W. Gambier-Bousfield.

and that which could so be utilized was found totally inefficient to light up the heavy vault. In the South with the brilliant sunshine much window-space was not only not needed, but was an actual disadvantage; but here, in the North, was a positive need of more light —than the absence of which perhaps nothing is more depressing. The question was, how shall more light be admitted without weakening the abutments of the vaults.

If our roofs are of stone, we cannot avoid the weight; therefore we must have strong walls to support them. But at the same time we must have more light; that is, we must pierce our walls to a greater extent than before. "What shall we do?" And this is what they did: they built four strong piers, two on each side of what was to be the future nave; they connected them by arches, the plan of which formed a parallelogram; they repeated this until they had reached the required length for their building, so that each set of piers arched over formed an abutment to its neighbor on either side. On the outside of these piers they constructed great buttresses, to resist the thrust of the cross arches, and thus they had a framework capable of supporting almost any weight—a framework in which every stone had its particular duty, without being overstrained or required to do too much. Between the piers on either side they could now build walls — mere screens, that need only be strong enough to support themselves; and these could be pierced with windows of any size; in fact, the larger the window, the lighter the wall. The only part of solid necessary was just so much as would secure privacy and protection from cold. This problem was at last solved, and having accomplished this in a rough state, they could proceed to beautify and refine it to their heart's content.



Abbaye des Dames, Caen.

The first thing to do now was to reduce the sizes of the great piers, for they occupied a great space, and were in the way of sound and light. By thinning them they would of course weaken them, and if they did this without making up for the loss of strength in another way, they would undoubtedly give way like weak knees. The foundations being sure, and the weight above pressing downwards, the attenuated cluster of shafts would certainly "buckle," split and fly, and down would the whole thing come. There was, however, no such great difficulty in this; it simply wanted a little consideration. The idea was to put horizontal struts from pier to pier, at two or three levels, and thus form a continuous band of support all round the building. But in carrying this idea out in stone it was found that the space between the piers was more than the bars or struts could span without some support for themselves, and again, these straight, stiff lines hardly harmonized with the graceful curves of the vaulting, and did much to take away that feeling of repose, the key-note of true art. By themselves they were simply constructional necessities. It was a small matter then to bracket under them from the piers themselves, to give them support in their centres, or, in other words, to construct an arch upon whose apex the horizontal stone course could rest, and of which the feet were supported by the piers. In this arch they had more strength than was actually needed for the support of the lowest horizontal bar. It would have been very natural if they had thrown arches across under each strut, repeating the method of support they had hit on for the lowest, but then they would have had additional weight on the piers, which was to be avoided as far as possible. The result would have been rather tame, and there would have been a great deal of *unused* strength. The lower "bar" having, as we have said, a support greater than its own necessities required, it was able itself in its turn to help in the support of other horizontal "bars" above it. A small pillar or cluster of shafts was erected on its centre, immediately above the apex of the arch beneath; and making this new feature the central pier for the support of a couple of arches, the bar above was supported in two places.

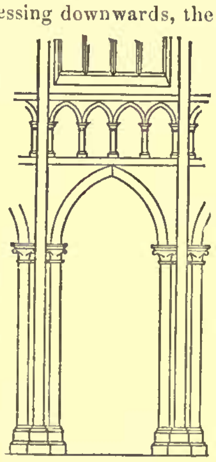
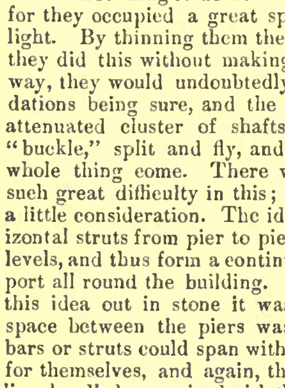


Diagram of Construction.

Our diagram shows an arcade of four small arches, which further help to support the upper struts, but which were added for ornament to the construction. Here was a band of great strength to resist the "buckling" attempts of the original piers, and a frame capable of any amount of decoration and ornament. Indeed, this simple constructional device has since been recognized as one of the most beautiful features of a Gothic nave. The "triforium," for such is its name, was attempted in Italy many years previously, but was never successfully treated, and was finally abandoned. But the reason for its introduction there was of a nature different from that in more Northern churches. Support was wanted for the great tunnel vault over the nave, and this was given by half vaults over the aisles, transmitting the thrust through them to buttresses on the outside of the walls, and so to the ground. This arrangement prevented the introduction of windows high up in what we should call the "clerestory." They had, however, window room in the upper part of the outside walls, below the springing of the half vaults; so here they cut their windows. The upper part of the nave walls they pierced with arches, thus admitting light but in very meagre quantities. Great churches of the Gothic age are not, as a rule, lighted through the triforium, although there are many exceptions, as at Peterboro', Beauvais, St. Stephen's, Caen, etc. The triforium usually opens into the roof over the aisles — that is, into the space between the vaulted ceiling and the outer roof. Where light is admitted through the triforium, there is a sense of weakness; the contrast between the clerestory and the dark triforium is lost, and there is altogether too much light. Romanesque architects had a way of lighting their domes, on a very different principle, piercing the vaults themselves, as shown above.



Issoire.



Nocera dei Pagani.

[To be continued.]

THE ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

THE ROTCH TRAVELLING SCHOLARSHIP DRAWINGS. PLATES XVII, XVIII, XIX, AND XX.

[Issued only with the Imperial edition.]

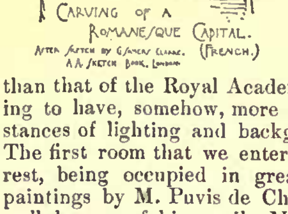
TWO SUBURBAN STORES, DORCHESTER, MASS. MR. W. W. LEWIS, ARCHITECT, BOSTON, MASS.

UNITED STATES COURT-HOUSE AND POST-OFFICE, ST. JOSEPH, MO. MR. M. E. BELL, SUPERVISING ARCHITECT.

COMPETITIVE DESIGNS FOR A $5,000 HOUSE, SUBMITTED BY "*Gosh,*" "*Hillside*" AND "*Château en Espagne.*"

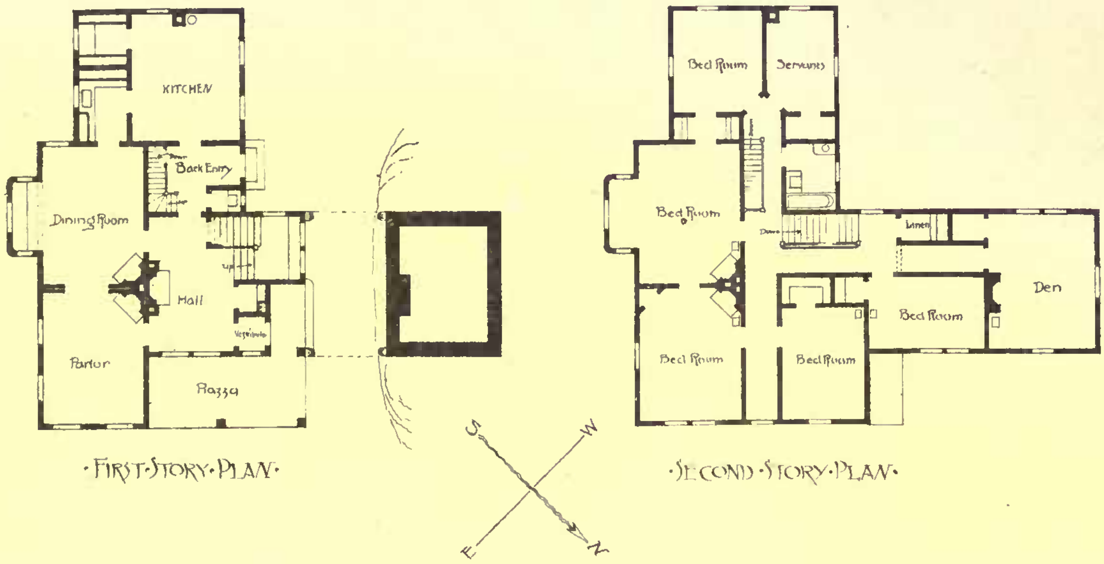
AN EDITOR'S TRIP ABROAD.[1] — V.

THE SALON. — NEW SCULPTURE AT THE LOUVRE. — THE HOTEL CONTINENTAL.



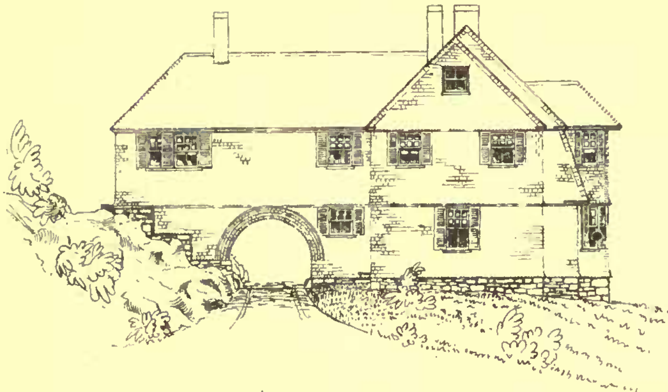
THE first feeling of one who undertakes to look at pictures in Paris usually, I suppose, approaches despair. There are so many of them, and they cover so many acres of ground, that it is not until after two or three days' work that one begins to see the possibility of taking a hasty glance at all the best ones. We knew that the Louvre would wait for us, while the *Salon* would not, and took the first opportunity of devoting ourselves to the almost endless galleries in the Palais de l'Industrie. The general appearance of the rooms was, to my mind, better than that of the Royal Academy galleries, most of the pictures seeming to have, somehow, more depth and color, although the circumstances of lighting and background were nearly the same for both. The first room that we entered was an interesting exception to the rest, being occupied in great part by three enormous decorative paintings by M. Puvis de Chavannes, and another, on the opposite wall, by one of his pupils, M. Frederic Montenard. I had always been curious to see something of Puvis de Chavannes's work, but must acknowledge that I was disappointed. The paintings, although in oil on canvas, were colored in close imitation of the chalky, bloomy tones of fresco, and seemed to me to lose all the richness and depth that could have been obtained by the use of oil, without gaining the stony, mosaic-like appearance which makes real fresco so beautiful in its proper place; while besides being evidently only abnormal oil paintings instead of fresco, the composition of the picture seemed to me unpleasantly scattered, and the figures lonely and stiff. M. Montenard's picture, on the opposite wall, was much more pleasing. Although he kept pretty conscientiously to the principle of imitating fresco work, his idea was less severely conventionalized, and in the painting of his beautiful foreground figure, there were indications that his natural inclination to bring out the charms of his ideal had had a hard struggle with the ascetic rules which he imposed on himself.

[1] Continued from page 30, No. 551.



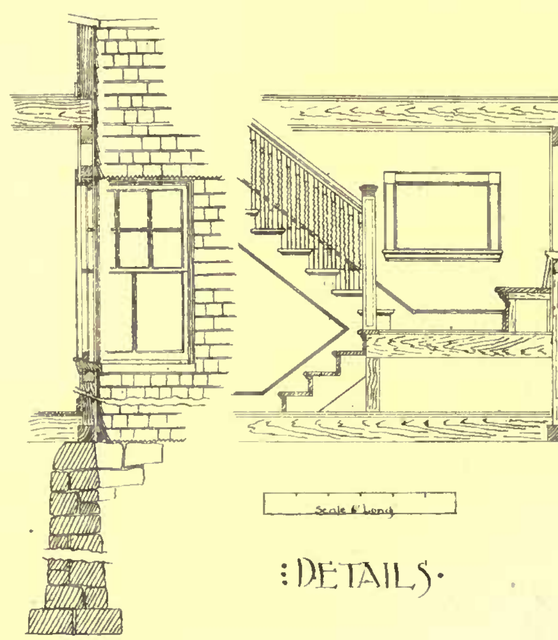
·FIRST·STORY·PLAN·

·SECOND·STORY·PLAN·

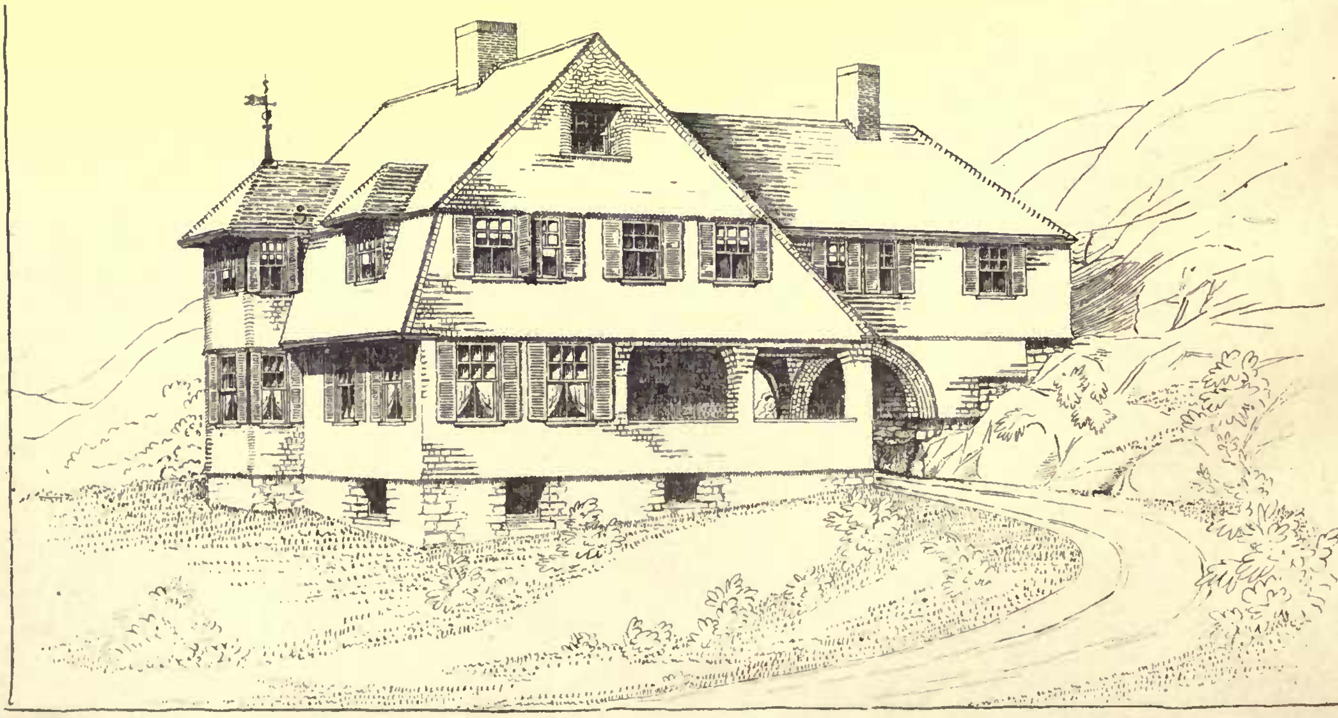


·REAR·ELEVATION·

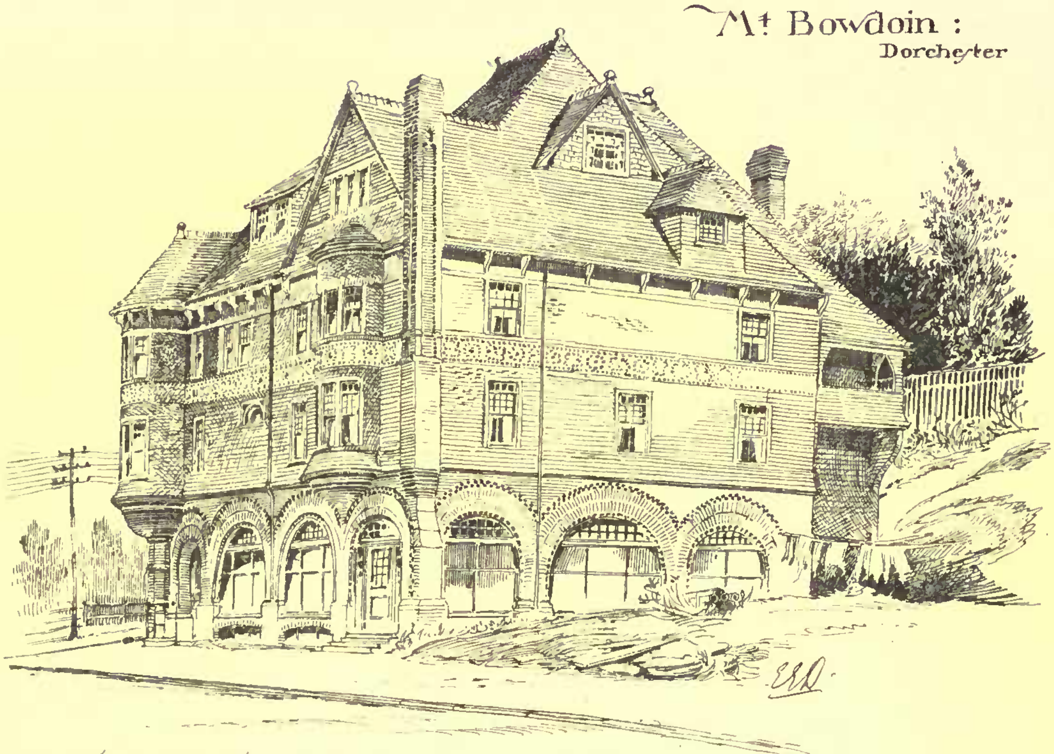
·AMERICAN·ARCHITECT·COMPETITION·
A·Small·Cottage to cost $5000
Submitted·by·"GOSH"·



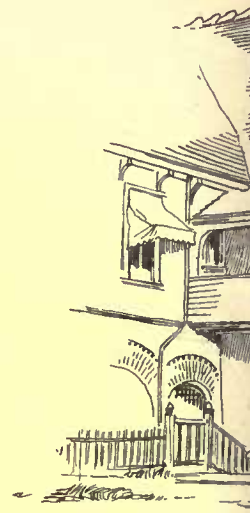
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Mt Bowdoin :
Dorchester

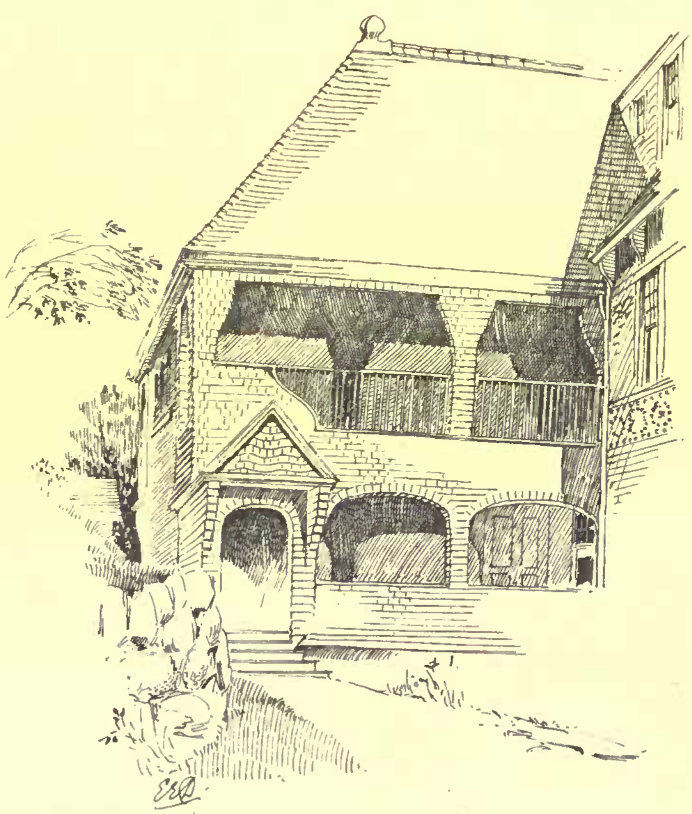


View from Washington St.

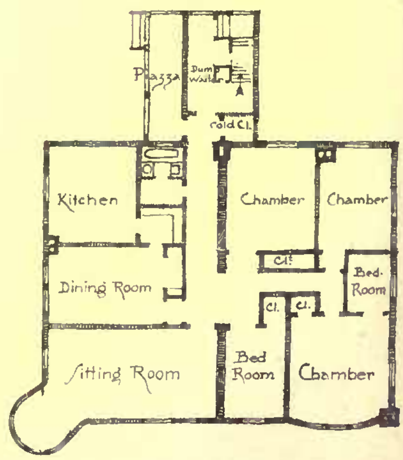


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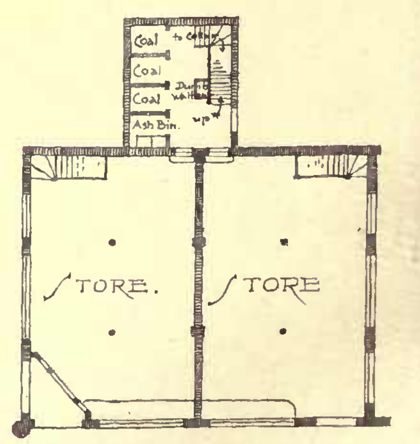
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Entrance to Tenements over the Mt Bowdowin Store.



Second Floor Plan



First F

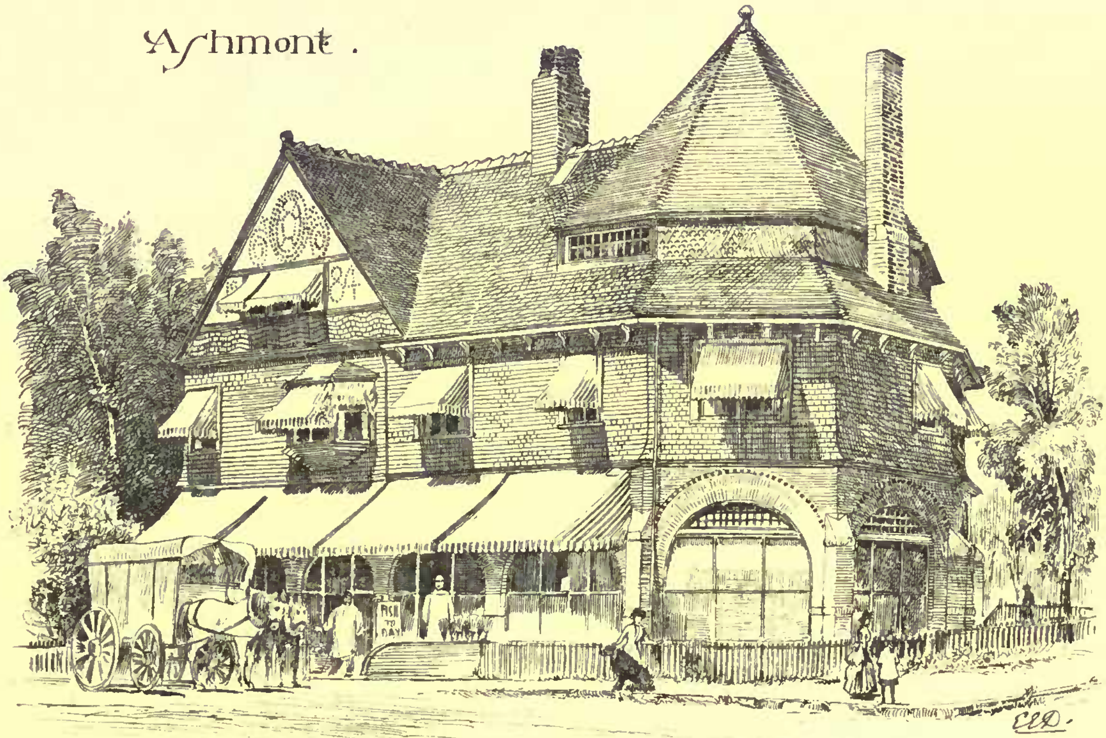
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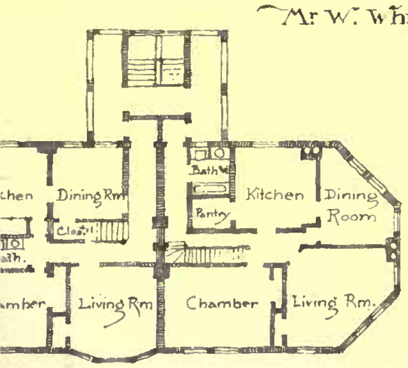
...e to House or Tenements
... over the Ashmont Store



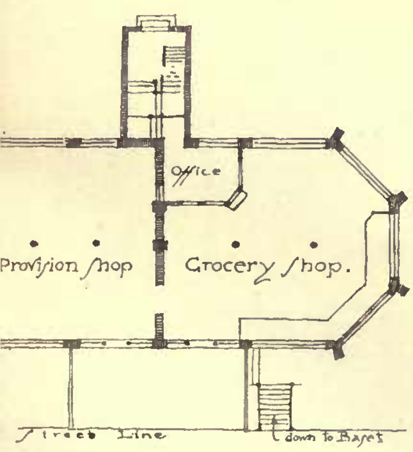
View from Dorchester Ave.

Suburban Stores. Boston: Mass:

Mr W. Whitney Lewis. Arhitect.



...ewing, "Tenements"



Plans

40 : 50 60 70 feet.



Octagonal End of Store.

Sketched by E. Eldon Deane.

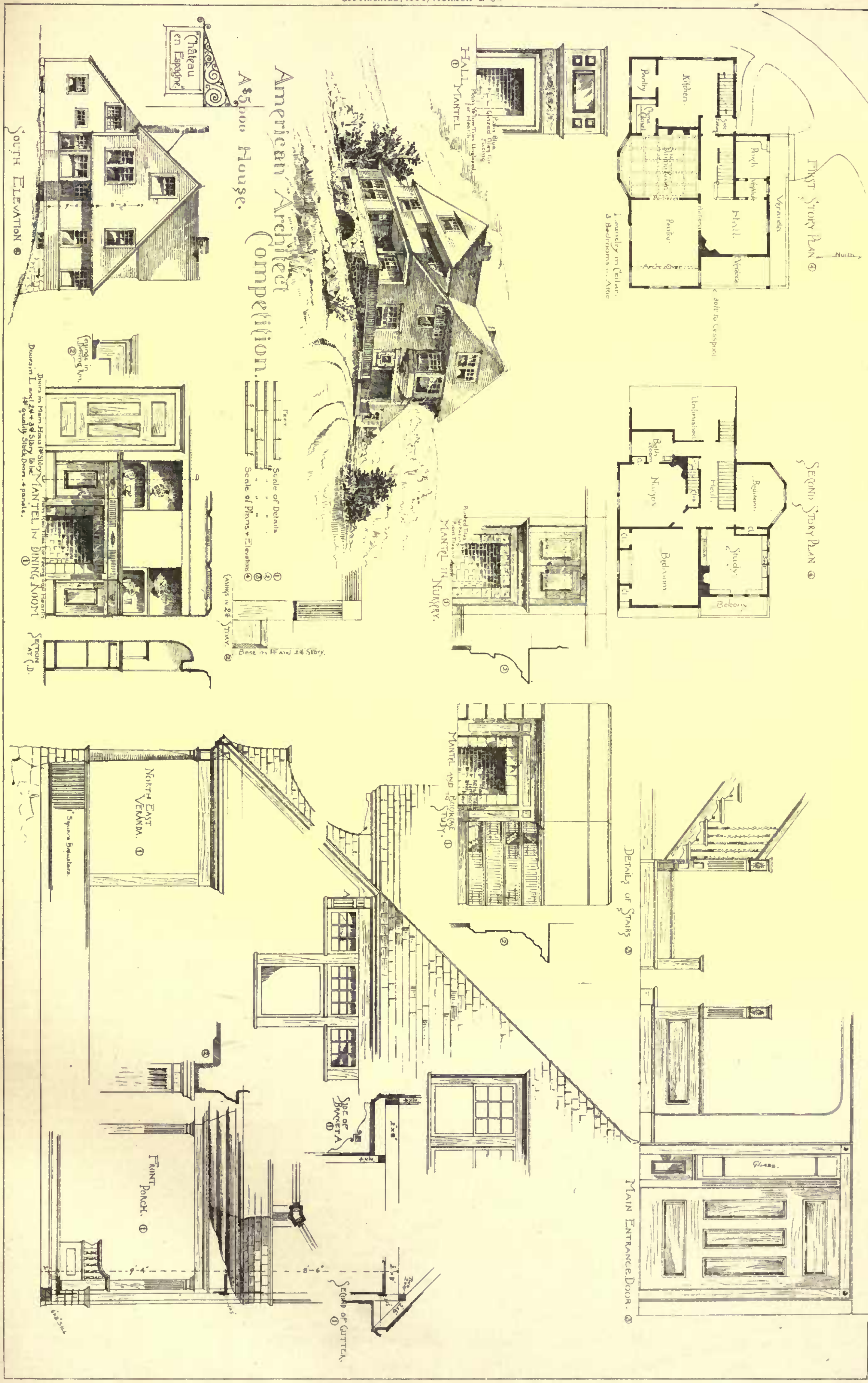
The Heliotype Printing Co. 211 Tremont St. Boston.



HELIOTYPE PRINTING CO. BOSTON

M. E. BELL
Supervising Architect.

Design
FOR
U. S. CT. Hº. & P. O.
ST JOSEPH, Mº.



American Architect Competition.
A $5000 House.
"Château en Espagne"
South Elevation
First Story Plan
Second Story Plan
Hall Mantel
Mantel in Dining Room
Mantel in Nursery
Mantel and Bookcase Study
North East Veranda
Front Porch
Details of Stairs
Main Entrance Door
Section of Gutter

It would be tiresome to attempt any sort of description of the pictures, and as nearly every French painter of any note was represented, even a list of the admirable ones would occupy a page. The best of the portraits, as well as the most interesting, seemed to to me one by Bonnat, of the great Pasteur and his granddaughter. Anything more nobly simple and straightforward than his rendering of the plain old man and the little girl clinging to his side it would be hard to conceive, and a second portrait near by, also by Bonnat, was nearly equal to it. Another picture, of a kind not very often attempted in France, but which pleased me greatly, was one by M. Victor Maree, representing a common little scene in a tenement-house, with a sheriff's officer carrying off a broken chair, the last piece of property of the female tenant, who sat quietly on the floor with her children. There was no need of looking at the title in the catalogue, "*Un lendemain de paye*," to understand the story at once, and, although unpleasantly black and heavy in color, the picture surpassed, in depth of feeling and expression, anything of the kind that I ever saw. There is a prevalent notion that artists in Paris dress up models in robes of various sorts, paint them, and give names to their studio groups after they are done; and there is, perhaps, some foundation for the idea; but if any one doubts whether French painters are capable of deep and unaffected sentiment, he should see how long he could look at this great picture without finding tears in his eyes.

It was rather pleasant to find that the American artists in Paris were very fully and honorably represented in the galleries. Mr. E. L. Weeks had one of his largest and best pictures in a prominent position, and many ladies, both French and American, exhibited. In fact, it was remarkable at the Grosvenor Gallery and the Royal Academy, as well as in Paris, that a very large part of the contributors were ladies, and that much of the best work belonged to them. Even among the endless nude figures of the *Salon*, the very best, as it seemed to me, was a nymph, by Mlle. Louise Nicolas, and in portraits, the average of the women's work appeared, both in England and France, superior to that of the men. There was a certain interest in looking at pictures by the artists most popular in America, and I was glad to find that the prettiest of the two Bouguereaus in the exhibition, "L'Amour désarmé," which I thought the sweetest and warmest Bouguereau I had ever seen, was already bought by a firm of Boston picture dealers.

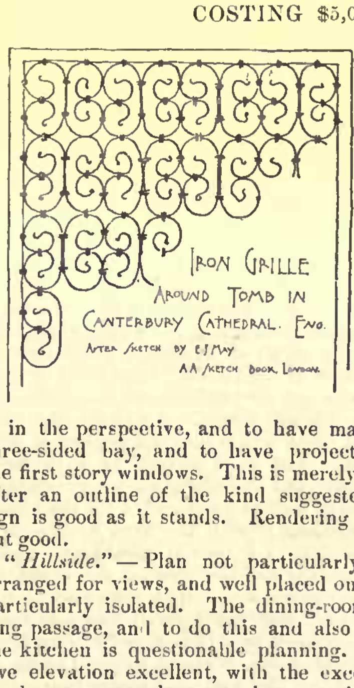
Unfortunately for the comfort of the spectators, all the pictures were not of the Bonnat or Bouguereau type in respect to choice of subject. It is certain that the French artists are not generally of a sanguinary disposition, but it must be something more than taste for novel effects in color which leads a good many of them to seek for inspiration in slaughter-houses. No doubt there is something attractive in a hog, with his throat just cut, hung up bleeding by the hind legs, with a cat lapping the blood to give animation to the scene; but I think an ignorant stranger might be forgiven for considering that the beauties of such subjects are so remote in character from those which we look for in peaceful landscapes and portraits of little living children as to make it desirable to keep the two sorts of pictures a little apart. Even the stuck-pig painting, although perhaps the baldest piece of butchery in the collection, was not more offensive than scores of others, representing men and women, of black, white, or yellow complexions, being hung, pounded, chopped, stabbed, strangled, or tortured in all sorts of ways, or than a nearly equal number which portrayed with frightful fidelity the appearance of the corpses of other persons whose woes were over. Unless French children are proof against nightmare, a good many of those who were in the galleries must have kept their mammas awake that night, and it seemed to me that not only the artistic unity of future exhibitions, but the domestic peace of those who visited them with their families, would be promoted by setting apart one room in the Palace for an abattoir and another for a receiving-tomb, in which the dead and wounded subjects could be gathered, under favorable circumstances for comparing their peculiar qualities, and out of sight of those whose tastes inclined them to prefer pictures of a different kind.

I had to look at the architectural drawings rather hastily, and neglect those in the corridor, to study a magnificent set of restorations by M. Blavette, of the temple of Demeter at Eleusis. Every one knows that in making colored geometrical drawings a French architect is unapproachable, but in these restorations, which were, of course, mostly hypothetical, appeared an inventiveness and knowledge of style and detail which were even more surprising than the beauty of the drawings. A great deal of the other work seemed to consist of students' essays, but there were many sets of plans, elevations and details of executed buildings, and a considerable number of sketches, mostly in water-colors, which were surprisingly good, many of them rivalling the English sketches at the Royal Academy.

At the Louvre I discovered one treasure which I had not seen before, in the shape of a noble statue of Victory, found, as the card in front of it said, in the island of Samothrace, and known to have been erected in honor of a naval victory gained by Demetrius Poliorcites in the year 305 B. C. Although the date was too late for the greatest age of Greek sculpture, the figure was most beautiful. The goddess was represented as standing near the prow of a war-vessel, which, sculptured in pure white marble, formed a singularly effective plinth to the statue. I should say that the figure was originally placed in front of an obelisk or, perhaps, the wall of a temple cell, and that the marble ship projected from the lower portion, resting partly, however, on a base of its own. The statue stood well out from whatever might have been the construction behind it, toward the front of the ship, resting mostly on one foot, in much the same attitude as the Venus of Milo, with drapery flying lightly behind it, and a pair of noble outspead wings. The whole figure was strikingly like the Venus of Milo, but the unemployed knee was less thrown forward, the drapery not being held upon it, while a light chitôn, I suppose I should call it, most exquisitely and tenderly sculptured, covered the upper portion of the body. Remembering Mr. Stillman's theory, that the Venus of Milo was really the statue of the divinity from the temple of the Wingless Victory at Athens, the obvious resemblance of the new figure appeared to me very curious; but the Athenians certainly gained nothing by their shallow conceit of making their Victory without wings, so that she could not fly away from them, and the Samothrace statue must have been far more picturesque and imposing than the other. With characteristic taste, the directors had placed this on the landing of the grand staircase, where it was as well-lighted and imposing as any one could desire, and with the Venus of Milo in her own room, and the Huntress Diana in the Le Caze room, the Louvre seems somehow full of the most majestic sculpture.

We were rather fortunate in being near to all the picture-galleries as well as to the numberless interesting things on the left bank of the river, through the accident of having wished to see the new Hôtel Continental, rather than those on the Boulevards. The Hôtel Continental was designed by Blondel, who seems to be one of the stockholders in the company which owns it, and he has certainly done himself the highest honor in the beautiful rooms which occupy the entrance floor. One is apt to look forward, on entering a new Paris hotel for the first time, simply to a few extra acres of imitation malachite alternating with counterfeit jasper on the walls, with mirrors of stupendous size between, but Blondel's staircases of Echaillon stone ascend between walls of factitious marble of a particularly subdued and modest tone, while his restaurant is a model of warm, rich and solid decoration. No malachite glares at you there, and even the iron columns are disguised under a comparatively inoffensive coat of plaster pophyry, while the walls glow with splendid Spanish leather, relieved against wainscoting and doors of ebony, inlaid with copper. The effect of the red copper ornamentation is wonderfully pleasant, and the same tone is kept in the rich bronzing of the coffered ceiling, painted very cleverly in the panels. Opposite the windows is the only piece of painting on the walls, an immense hunting-scene by Luminais, painted for the room, and giving a far better effect than could have been obtained by a dozen smaller pictures scattered about, or by the mirrors which Parisians generally use so recklessly, but which M. Blondel had the good sense to dispense with here. The plan of the house is a pretty as well as unusual one: the hotel, occupying all, or nearly all, of the block, it was necessary to arrange it with two courts; one of these, as in all large hotels, serves as an entrance court, and is as richly decorated as it is usual for "*cours d'honneur*" to be, but the other, which is enclosed on all sides, instead of being left with bare walls, and devoted to boot-blacking and dish-washing, is even more highly ornamented, on the entrance floor, than the other, and is covered with glass and utilized as a sort of winter-garden, under the name of "*Cour des Fêtes*," which can, on occasion, be thrown into connection with the great reception-rooms which surround it.

AMERICAN ARCHITECT COMPETITION FOR HOUSE COSTING $5,000.[1]—II.



"*GOSH.*"— Plan is fairly good. There is waste room in halls. The novelist is isolated. Details are simple and good. The exterior design is among the best sent in. It is doubtful, however, if so short a gambrel ever looks well. It usually needs a length of ridge at least half as much again as the width of the base of the gambrel. It might have been as well to have forsaken the gambrel treatment, made a heavy projection above second-story window where small dormer is in the perspective, and to have made the dining-room bay a flat, three-sided bay, and to have projected a strong belt-course over the first story windows. This is merely a suggestion, and is only given after an outline of the kind suggested has been tried. The design is good as it stands. Rendering (except of elevation) is coarse but good.

"*Hillside.*" — Plan not particularly good, though house is well arranged for views, and well placed on the hill. The novelist is not particularly isolated. The dining-room is isolated at the end of a long passage, and to do this and also make library in proximity to the kitchen is questionable planning. Details are good. Perspective elevation excellent, with the exception of the flap dormer and the buttresses to the steps, but opposite elevation is not at all good.

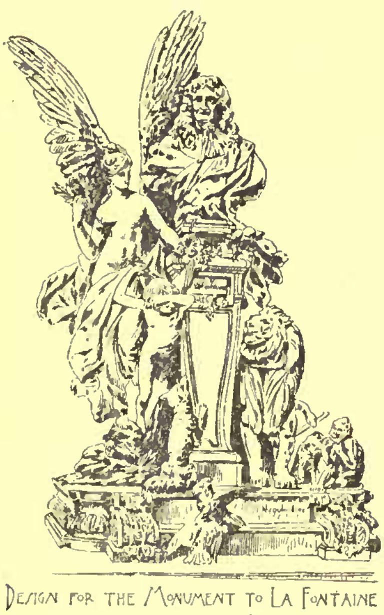
[1] Continued from page 27, No. 551.

Two-storied narrow perpendicular dormers on a long, low, gambrel-roofed house are deliberate contradictions to the general spirit of such a house. Rendering good, except of stonework, the joints and shadows of which have too many diagonal lines.

"*Château en Espagne*."—Plan, fairly good. Compact and simple, but no especial provision made for novelist. Details good; exterior, too much cut up upon walls. Bedroom bay and projection over, too heavy for mass of house. Study balcony cuts house wall up too much; with these changes the house would not only be simple but apparently enlarged. Rendering clear and good

[To be continued.]

PICTURES OF THE SEASON IN NEW YORK.[1] — VI.



Design for the Monument to La Fontaine to be erected in Paris.

Last year, as may be remembered, the Society of American Artists, to which we have accustomed ourselves to look for the most interesting native exhibition of the season, showed us nothing whatsoever. This year it reveals itself again, although in a place where we hardly should have thought to find it. Its collection forms the summer loan-exhibition of the Metropolitan Museum, and hangs in one of the west galleries. This is not to say that the Museum authorities had any hand in directing the exhibition—they simply gave up the room to the Society which chose and hung the pictures quite as it thought best. The committee on admissions was unusually large, and worked upon a new scheme, than which none could have been more painstaking and conscientious. The result is a small but most interesting collection which we are glad to have at the Museum rather than elsewhere, as it will remain on view during the whole summer, and will be seen by a quite different class of visitors from those who ordinarily seek out the "pay" exhibitions in other places.

The first thing that strikes the observer, is, I think, the brilliant yet harmonious general aspect of the room. Certainly to-day the "new men" are not afraid of color, and have pretty well worked-out of the heavy browns and dull grays which once spoke so strongly of their paramount love for "tone." After the Impressionist exhibition with its stunning chords of unadulterated color, its dazzling crudities, its bright notes looking like bits of the rainbow itself, we might have expected any other show to look a trifle tame by comparison. But this one is far from tame in its total effect, though marked, certainly, by something more of reticence than its foreign predecessor.

Among the one hundred and twenty-one works which are all it shows, portraits hold, as ever, a conspicuous rank by reason of numbers, and, I am tempted to say, the first rank by reason of varied excellence. Mr. Beckwith's likeness of Mr. Walton,—a life-size three-quarter figure—is, as might be guessed, vigorous, facile, and almost startlingly alive, though lacking in charm and somewhat in artistic refinement. It would have been more pleasing, it seems to me, but for the background, which, being a wall close at hand and covered with sketches in color, somewhat confuses the eye, and gives the picture a scrappy and restless effect. Mr. Rice's portrait of Mr. Beckwith himself belongs, I should say, to the same class of art, but is more agreeable in composition. The painter in this case is one of the newest of the new men, but one who has immediately taken rank among the cleverest. Even better evidence of his ability than this picture affords was given by a portrait of President Hitchcock in his academic robes that was shown at the Century Club not long ago. It was strongly painted yet with all due refinement and delicacy, and posed with great feeling for life and action, yet without that visible effort to secure the effect of these which means a neglect of simplicity and straightforwardness. The head seemed to have been rendered with great verisimilitude and the whole work was interesting, intellectually — so to say — as well as technically; for the model showed a characteristically American type of the kind we like best to feel *is* characteristically American — a type at once keen, intelligent, refined and genial, the scholar and the man of the world in combination—and had been interpreted with happy sympathy on the artist's part. I could not but wish that this portrait had also been included in the Society's exhibition—if only that it might have been compared with Mr. Holl's likeness of Mr. Warren, which I think, is the only work of foreign origin on the wall and which previously hung for a long period in the Museum of Fine Arts in Boston. Mr. Holl, as every one knows, stands very high among the portrait-painters of England and I saw no likenesses in London last year which were better than his save only those of Sir John Millais, who, of course, is not to be weighed in the balance with any of his fellow-countrymen. Yet had Mr. Rice's work hung beside Mr. Holl's, I do not think we should have given the palm to the latter.

But in a general appraisement of *all* the portraits on the wall the palm could hardly have been bestowed elsewhere than into Mr. Sargent's hands—not for his brilliant and extremely clever but somewhat unsympathetic and aggressive half-figure of a young lady dressed in black and white, but for his group of an elderly gentleman and his wife which, although now for the first time exhibited, was painted some three or four years ago. Never, so far as I have seen, does Mr. Sargent paint his models superficially in the sense of painting the mere surface and semblance of a human being without indicating that anything to be called an individual soul lies beneath. But sometimes he paints them superficially in the sense of painting one of the soul's most superficial phases. When he portrays a lady in evening dress, for instance—as in the picture first noted above—he interprets her "society" self rather than the truer self which, we are optimistic enough to believe, must exist a little deeper down. Perhaps we can hardly blame him for thus making clothes and expression "in keeping" with one another: if there is a fault in the matter it lies, I should say, with the model's own choice of costume. But all the same, portraits are more attractive, and, I think, hold a higher rank as works of art when they are more simply and sympathetically *human* in conception. And that Mr. Sargent can thus conceive them upon occasion is amply proved by the double portrait in question. It was a somewhat daring undertaking to paint two standing, three-quarter figures, with the lady much shorter than her husband, leaning upon his arm, and this in the most simple way—with no accessories and no background save a mere dark tone. The lady is in black, so the work attracts by no brilliancy of color; but it is most admirable in tonality, the gentleman's long white beard striking no note of discord in the subdued general scheme. The faces—I may, perhaps, venture to say that in this instance I speak from personal knowledge—are thoroughly successful as portraits, and, as I have just hinted, successful in that best way which interprets the more characteristic, more intimate phases of character. There is never any hint of "commonness" in Mr. Sargent's work—his models always look well-bred, and show that a kindred hand has painted them. But in this instance the union of high-bred refinement with interesting personalities is so attractive that we almost forget to dwell upon the merely technical qualities of the picture. Yet these, of course, are very great—anything more superb than the way in which the hands, for example, have been treated, it would be hard to find in the results of any modern brush.

Mr. Lowell Dyer shows a three-quarter-length portrait of a lady, the head of which is so much more interesting than the rest that we should like to see the canvas so reduced in size as to show it alone. Miss Lesley's portrait of two sisters, seated, in evening dress, reveals some strong painting, but is disagreeable in other ways as well as in its lack of refinement. Mr. Porter is certainly not at his best in a small half-length of a blonde young woman, painted in very bright colors and with a very porcelain-like elaboration. It is a singular work to be signed by an American name — reminding us strongly of those sentimentalizing little portraits of pretty faces which are so characteristic of the North-German school, and have so often been reproduced (with no very bad sense of fitness) upon the actual porcelain of plates and plaques. Miss Sackett shows a graceful, small portrait-study, and Miss Caroline Hecker some very excellent heads in pastel — broad and strong in execution, yet having great truth of texture, as well as charm of color. The most ambitious pastel in the collection, however, is by Mr. Chase — the full-length, life-size figure of a girl in white. The very strong illumination gives the face a somewhat disagreeable chalky hue, but otherwise there is great beauty in the work, and that of a kind which at one time we did not expect from just this hand. I mean that it shows much feeling and feeling of a very refined description, as well as much technical cleverness. Another portrait by Mr. Chase — painted in oil on a very coarse surface — is fine in color (the young lady being in black against a blue curtain) and brilliant in technique, but by no means so attractive in sentiment as the other or so individual in conception. One would be consoled for more failings than these, however, by the sight of such delightful handiwork as is shown, for instance, in the rendering of the different qualities of black in the lady's pretty costume.

Of all the portraits in the exhibition the hardest to describe are, as always, Mr. Abbott Thayer's. It is impossible not to see at once that they are the work not of a painter merely, but of an artist, and impossible not to feel their great individuality and its charm. But this charm makes itself felt, at times, rather in despite of than by reason of the manner of their execution. Or, if this is too strong an expression — and doubtless it is, for the impression given can never really be in disharmony with the method used — I will say that the execution sometimes seems to fall short of expressing wholly and perfectly that which the artist wished to say. The most ambitious portrait in this collection, for example, shows a mother seated with her child on her lap. Her dress is black and very simple, and her large cloak lined with blue. The child's face is admirably realized and very lovely, but the mother's charms are marked by a

[1] Continued from No. 548, page 305.

certain vagueness and uncertainty of rendering. As in some other pictures shown in previous years, we feel that the curiously "tormented" technique of more than one portion seems to prove that the artist himself was not wholly satisfied with his result even when he consented to hold his hand — to prove, I repeat, that he had not perfectly realized, even to his own satisfaction just what he wished to do. But we also feel that this has been because he wished to do something of real value and of more than usual subtility and difficulty — and the somewhat imperfect result impresses us, therefore, more than the bold, direct and wholly adequate expression of more commonplace and shallower intentions. Of course this would not be the case did expression fall *very much* short of complete clearness and decision; and I am not quite sure, even, that I am right in calling the degree of indefiniteness and indecision which we note, an "imperfection." In certain moods we are tempted to feel, before the pictures which exhibit it, that their quality of *suggestiveness* would be poorly replaced by greater definiteness since this might mean a narrower limit to our imagination; that their half-pathetic charm would be lessened were their figures brought, so to say, more completely into the light of common day. This is especially true, I think, of another portrait in this exhibition — the head of a young man. Many observers, I find, deem it far less "successful" than a third — which shows, in a delightfully decorative scheme, the half-figure of a little girl and is painted with all the straightforwardness and decision any one could ask. And so I thought myself at the first glance. But longer acquaintance proved the other by far more interesting, despite of — or should I say *because* of? — the curious indefiniteness of its rendering. Perhaps the model has in life but the ordinary attractiveness of the average unpoetic male; but on this canvas, while he is life-like enough, I dare say, to seem quite himself to the eyes of his friends, he has a mysterious charm for the eye of a stranger — gives us that food for the imagination which very few pictures, even of professedly "imaginative" sorts, afford.

Another admirable portrait and another which is admirable because it has meaning and feeling first and cleverness only in the second place — is Mr. Alden Weir's of Mr. R. H. Stoddard. A painter is fortunate when he has as a sitter a well-known person *if* that person's aspect is in keeping with the idea we are likely to have formed of it. How good the individual likeness in this case may be I know not, but it seems as though it must be very good — the picture strikes us as being so typical. It is very simple — the three-quarter figure of an elderly man with a beard, holding a small book to his breast in the most natural, unselfconscious way. Clever and sympathetic as was the portrait of Dr. Hitchcock by Mr. Rice, which I named a while ago, this is still better, for it has more value as pure pictorial art, and is still more sympathetic and in a deeper way. When one year can sho us sow many good portraits as these I have noted in this and my preceding chapters, I do not think we ought to be less than very proud and very grateful over our recent advance in this branch of our art at least.

And among the portraits in the Society's exhibition I am tempted also to include Miss Trotter's life-size figure of a Breton peasant woman coming down a path in full light with a bundle of sticks under her arm and, of course, a blue gown. It is, as will be felt, of a class with which we have been made very familiar of late years by many young Americans who have studied abroad. But it is so much more vital in feeling and so much stronger in its individualization of character than most of its fellows, that it merits better treatment than to be ranked as a mere study or piece of imitative practice-work. Long ago (I mean long ago as we count time in this rapid land of ours — four or five years since) I used to see examples of Miss Trotter's work on the walls of the Philadelphia Academy and to think that the vigorous "realistic" teaching of Mr. Eakins had better material to work upon in her case than in that of almost any of her fellow-students. Seeing now this strong and extremely well-balanced piece of work (which proves, I suppose, that she has since sought help at the fountain-head of modern art), I do not feel that my prognostications were at fault. May she only in the near future give us other figures as well done, but better worth the doing! Of course I do not mean intrinsically — for intrinsically her fine young peasant well deserved the labor of any one's brush. I mean better worth doing in the sense of *less often done before, and more characteristically our own.* What I want is that Miss Trotter, and any and every one else who is as accomplished and as earnest as she, should now begin to give us some of those pictures we are waiting for and longing for in order that we may feel we have good American painters and not merely good Americans who can paint French pictures. In conclusion I may note as both clever and interesting Mr. Fitz's portrait of an old woman, and as one of the two or three very best things the year has shown us in any branch of art, Mr. Augustus St. Gaudens's beautiful full-length bas-relief of two children with their dog. But any attempt to characterize the excellence of this last had better be deferred until I can speak at the same time of another recent work by the same hand.

M. G. VAN RENSSELAER.

THE RAPACIOUS MICHIGAN LUMBERMAN.— Every acre of pine land in Michigan has been purchased from the Government. It is stated that Michigan men have purchased nearly a million and a half of acres of the long-leaved pine lands of Louisiana and Mississippi lately at a cost of $1.25 per acre — a total of something like $1,800,000 having been paid for them. It is believed that the standing timber aggregates 15,000,000,000 feet of timber.— *Iron Age.*

SOCIETIES

PROPOSED MEMORIAL TO H. H. RICHARDSON.

THE Board of Trustees of the American Institute of Architects has addressed the following letter to the several Chapters:

NEWPORT, R. I., July 1, 1886.

TO ——, SECRETARY OF —— CHAPTER A. I. A.: —

Dear Sir,— At the last meeting of the Board of Trustees A. I. A., a paper was received from the Secretary of the Boston Society of Architects requesting that the Board call the attention of the several Chapters of the Institute to the proposed erection of a monument to the memory of the late H. H. Richardson, architect, and asking the Chapter's aid in that connection.

I was instructed to bring the matter to your notice.

At the same time the Board instructed me to request your Chapter to appoint a committee to confer with the Boston Society, the president of your Chapter to be a member and the chairman of said committee. Please give this matter your attention. Letters from your committee to be addressed to Edmund M. Wheelwright, Secretary, 6 Beacon Street, Boston, Mass.

The membership of the Boston Committee is as follows: Messrs. E. C. Cabot, Robert S. Peabody, Arthur Rotch, Robert I. Andrews and Edmund M. Wheelwright. Very truly yours,

GEO. C. MASON, JR., *Secretary A. I. A.*

SEMI-ANNUAL MEETING OF THE OHIO ASSOCIATION OF ARCHITECTS.

THE Ohio Association of Architects held their second semi-annual meeting in the parlors of the Burnet House, Cincinnati, July 12. President George W. Rapp called the meeting to order and delivered the opening address, wherein he bade the visitors welcome and pointed out in a concise way what should be the policy of the society for the next six months.

The treasurer's report showed a healthy state in that direction. The society adopted the schedule of charges of the American Institute, and also adopted the code adopted by the Western Association governing competitions. The Association appointed a committee of three to investigate the matter of the recent Hamilton County, Ohio, Lunatic Asylum competition, wherein certain architects (members of this society) submitted "bids" for the making of plans, specifications, etc., after having signed an agreement not to do so. In the afternoon a visit was made to the studio of Mr. Matt Morgan where was viewed one of the series of pictures (about 30′ x 50′), illustrating the late war. After this the members visited several of the residences of Clifton and elsewhere. Among those present were F. O. Weary, Akron; J. W. Yost, Columbus; S. R. Burns, Dayton; H. A. Lurthwaite, Columbus; C. B. Cook, Chillicothe; A. Rutti, Hamilton; James W. McLaughlin, George W. Rapp, Charles Crapsey, W. R. Forbush, O. C. Smith, D. S. Shuerman, Theodore Richter, and William Martin Aiken, all of Cincinnati.

COMMUNICATIONS

[*We cannot pay attention to the demands of correspondents who forget to give their names and addresses as guaranty of good faith.*]

PERSPECTIVE.

WASHINGTON, D. C., July 17, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you kindly inform me as to the best work on perspective, both in and exterior, and where it can be had?

Yours respectfully, X.

["*Modern Perspective,*" by Prof. W. R. Ware, of Columbia College, New York, published by Ticknor & Co., price $5.—EDS. AMERICAN ARCHITECT.

HOUSE TANKS.

DEKALB, ILL., July 12, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Please answer the following in your earliest issue of the *American Architect.*

In a house to be built — a small dwelling — it is desired to build a tank in second story from which to run a range boiler. The house is heated by base-burner stoves; no steam nor furnace. Can the tank be made so as not to freeze in winter, *and how?*

Will a stove chimney running up past it suffice to prevent freezing, provided a stove is run day and night?

Is an unlined wood tank considered safe from leakage if good when put in? Please answer at once, and oblige a subscriber.

GEORGE F. BARBER.

[IF the attic in which the tank is to be placed is reasonably air-tight, a double-cased tank packed between the casings with about four inches of sawdust and provided with a similarly-lined cover, will probably be safe against freezing in a house warmed as you suggest. It should be placed near the kitchen chimney if possible. A wooden tank made by a cooper could be used unlined, but even then it would be less safe than a lined tank. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

Burning of the University at Brussels.— A terrible fire broke out to-day (Wednesday, July 7), at 1 o'clock, destroyed the greater part of the Brussels University. It began while the juries of professors were examining the candidates for doctorships. The roof of the left wing soon fell in with a terrible crash. The professors and students rushed to the library in the hope of saving the books, but what they succeeded in rescuing are valuless, being incomplete. The huge cupola over the academy hall afterward fell in, many of the students having a narrow escape. In a short time nearly the whole of the building was in flames, and the firemen only preserved the right wing by strenuous efforts, two of them being severely injured while doing their duty. The precious collection of minerals was entirely destroyed. However, the surgical instruments were saved. An immense crowd collected, among whom Prince Beaudoin, the nephew of the king, was present. The buildings were not insured and the loss is great. It was only last year that the fiftieth anniversary of the foundation of the university was celebrated. By a strange coincidence another fire had broken out early this morning at the other end of the city and destroyed a large shoe factory, putting 350 workmen out of work.— *N. Y. Herald.*

Theatres and Theatre-goers Burned. — A good many theatres have been burned during the last 130 years, and quite a number of people have been sacrificed with them, though not so many as might have been expected. In the more modern structures, supplied with devices looking to the preservation of life the mortality is, of course, not so great, though it is quite large enough. Dr. Choquet has laid before the Paris Statistical Society some returns on the subject in which he gives the total number of theatres destroyed at 632, of which 51 were burnt down in the last half of the eighteenth century, 51 in the first quarter of this century, 100 from 1825 to 1850, 76 from 1850 to 1860, 103 from 1860 to 1870, 169 from 1870 to 1880, and 174 from 1880 to the end of last year; while three theatres at Detroit, Madrid and Orleans have been burnt this year. The number of persons who have perished in the flames varies very much; for, while 1,010 were burnt to death between 1790 and 1800, and 2,144 between 1840 and 1850, the total was only 241 for the ten years from 1850 to 1860. This is due to the fact that now and again some theatre is burnt down while full of people, as was the case in 1794, when 1,000 persons perished in the theatre at Capo d'Istria; in 1836, when 800 persons were burnt at St. Petersburg; and in 1845, when 1,670 persons perished in a Canton theatre. The worst fires of the last few years have been at Vienna, where 450 people perished in the Ring Theatre in 1881, and at Nice, where 70 persons were burnt to death in the same year. Altogether 6,573 persons have perished in the last 135 years, or 48 persons in every year, this being a very small percentage of the whole theatre-going population.— *The Investigator.*

Incidents of Daily Life in Spain.—This is the summing up given by one who has made a recent visit to Spain: Wherever one goes in Spain the irreverence for the dead, and, as a matter of course, the recklessness of life are what most prominently strike a traveller. The people seem actually to be indifferent to manslaughter. On the slightest provocation blood is shed, and the moment a revolver is heard in the street or a shriek from a murdered man, every door is shut and there is a scurrying of feet in a direction opposite to that in which the assassin has fled. Everybody is afraid of being seized as the criminal. Not a night during the hot, dry summer passes without the cry of fire being heard in a Spanish town. Any person in the street at the moment can be pressed to aid in extinguishing the flames. But it is rare that any one is found to perform that duty, for at the first cry of fire prudent citizens take care to get under shelter. In the interior, and even in the large cities on the coast, the cemeteries are in a deplorable condition. It is not an uncommon spectacle to see a body flung across a mule, or even two being carried in this fashion to their last resting-place, amid the heartless, often brutal comments of the bystanders, who, notwithstanding, always doff their hats, out of a half-superstitious feeling, the exact character of which never costs them a thought. These traits refer mainly to the country folks, or to the townspeople of the poorer class. They, however represent the Spanish character better than the more polished citizens, who, in Spain, as in every other country, have overlaid their native manners by a certain veneer of conventionality, which is in reality common to the cultured society of the world at large. — *N. Y. Mail and Express.*

The Iron Spire of St. Stephen's, Vienna. — The ancient church of St. Stephen is supposed to have been founded in the year 1144, by Heinrich Jasomirgott, afterwards the first Duke of Austria, one of the twenty-three children of Agneseus, to whom the Klosternenburgh owes its foundation. The church seems to have been several times injured by fire, and in 1519 by severe earthquakes, which did great injury to the buildings in Vienna and the vicinity, and on these occasions to have been partly rebuilt and much enlarged. The tower, as built or restored in 1519, in process of time deviated out of the perpendicular to a considerable extent. An iron bar was carried through it as an axis for the support of the spire, which, having a considerable tendency to vibrate, might be considered as an element of destruction rather than of strength; consequently the thin wall of the lower portion of the spire was reduced almost to a ruin, and at length became in such a dangerous condition as to require rebuilding. The removal of the old spire was commenced in August, 1839, and in the following spring all the condemned part had been removed The mode of construction adopted in the restoration was novel and ingenious, the slight masonry of the spire being supported by means of a framing of vertical iron ribs, fastened at their lower extremities to a cast-iron plate or base, and united to each other at intervals by horizontal rings of rolled iron. These rings are made to project from the inner surface, so as to admit of a person ascending, with the assistance of ladders, to the top of the spire. All the wrought and rolled iron employed in the construction of this iron skeleton, the weight of which was only 123 cwt., was prepared in the Government works at Neuberg, in Styria. The cast-iron plates or rings were furnished from the Government iron-works at Marie-zell. In the autumn of 1842, when the whole of the masonry of the spire had been completed, the upper portion, consisting entirely of iron work, was fixed. This also was attached to a strong cast-iron circular plate, similar in construction to that below. This portion of the framing, with the other ironwork employed in the spire weighed about 80 cwt., so that the entire weight of iron was about 203 cwt. The new portion of the spire was connected to the old by means of an arrangement of ironwork, very appropriately called "anchor fastenings." The portion of the spire restored (viz., from the gallery of the tower to the top of the cross), is about 182 feet, the cost thereof being about 130,000 gulden, of which sum 15,500 gulden were expended in taking down the old spire and in the construction of the necessary scaffolding.— *W. M. Higgin.*

TRADE SURVEYS

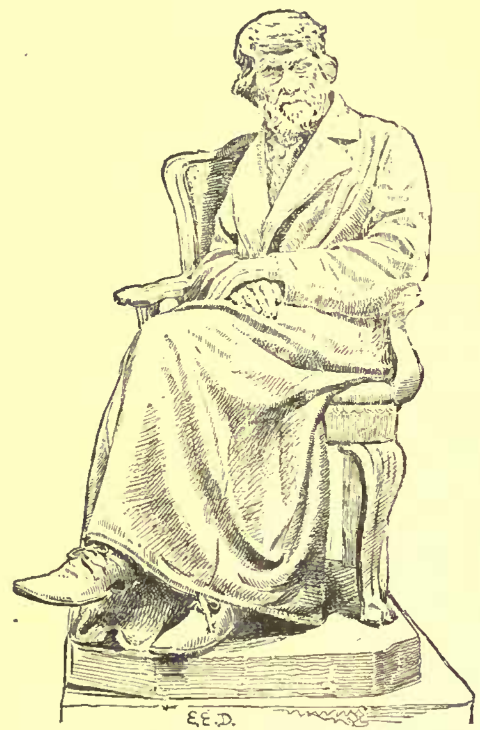
Two influences are working beneath the surface, viz., one to advance prices and an other to depress them. Under these antagonistic forces a half dozen or more staple products are to-day higher than they have been for twelve or eighteen months, while another set are slightly lower. The strong feature at present and likely to be so for some months to come, is the demand occasioned by the activity in railway construction. Last week the steel rail syndicate increased the allotment to 1,400,000 tons with over five months yet before us. Prices which run between $34 to $36 would bound three to five dollars per ton higher but for the protection secured by the possibilities of higher prices. The mills were never more crowded and capacity never greater, and never were there as many schemes for new works and extensions of old ones as at this time. Special reference to the iron and steel industries at this time is necessary. New blast-furnaces and mills are projected North and South. Improved devices are going in as fast as labor can effect the changes. Productive capacity will be expanded to eight million tons per year, no doubt, before it is checked. Ores and crude iron for Bessemer processes are high and likely to advance. The car-builders never had more business in sight. Nearly all the railroad companies are in the market for new cars, one order being for forty-nine sleepers. The trunk lines are short of coal and freight cars and the orders practically secured for July will put nearly all the larger concerns in a better condition than they have been for two years. Most, if not all this new business has been secured at five to ten per cent below last year's prices, despite the advance in many kinds of material and many branches of labor. A downward tendency is at work in most kinds of material. Even lumber is not strong where large buyers are to be captured. If high prices are paid it is the small buyer who pays them. The crops are engaging the attention of the Western farmers, and hence some check has been given to the heretofore liberal distribution of iron, steel, lumber, and other heavy raw products. Large lumber orders are being placed this month in Western and Southern markets. A summary of last week's building permits indicates a falling off, but this was expected. The only scarcity in building material is in brick, and orders are crowding manufacturers at several points. All makers are crowded. Laths and shingles command full prices in Eastern and Western markets. Prices are not jeopardized by fluctuating freight-rates and are likely to remain regular. The builders in Chicago, Minneapolis, Detroit and along the lakes are making inquiries at Cleveland, Chicago, and other lumber centres for fall and winter stocks, and if lumber-dealers' opinions are to be accepted sales will swell to larger than ordinary proportions because of a stocking-up movement, especially in hardwoods, for which there is a particularly strong demand. Western railroads have undertaken an "equalizing" of rates, which practically amounts to an advance between non-competitive points. Real estate transactions cannot be intelligently summarized, but the closest safe approximation of the real estate situation is about this. Former values are generally held. But little real estate is being marked up. Holders and owners prefer to take advantage of the present era of building activity to get rid of sites and tracts in urban and suburban districts. Improving travelling facilities have helped to bring this about. Suburban real estate is advancing, relatively at least, faster than unimproved lots in the city. Manufacturers are moving out farther and house builders prefer to purchase farther and farther from overcrowded centres. Builders in Western cities speak particularly of this. The organization of the real estate interests is attracting attention. The success of the New York Exchange has led to the formation of exchanges in Philadelphia and Baltimore, and in some smaller inland cities the question of organization is being discussed. As regards building prospects for the next four or five months, there seems to be no cause for modification of former statements. New York building is going ahead, and an effort may be made there to make real estate available as collateral in the money market. At Philadelphia a number of large building enterprises will be undertaken next month. Throughout the interior of Pennsylvania houses for workingmen are being erected by the hundreds to rent at from $8 to $12 per month. At Pittsburgh productive capacity is at its maximum limit, and building is gaining ground. Cleveland and Cincinnati are quite active and Louisville is making headway. West of the Mississippi matters are less satisfactory. While railroad building is progressing rapidly and house and shop building in the region of country from Central Iowa northward, there seem to be conflicting reports and advices from the region south, excepting in cities like Kansas City and the leading Kansas towns. The architects are as a class fairly well employed, although their services are not required in the great bulk of the chief and ordinary work done. Public building is being pushed. Banks, store-houses, fine private residences, breweries and manufacturing establishments are in sufficient number to furnish steady work to the great body of capable architects. The far West proves to be an inviting field to many who are able and willing to combine the capabilities of both architect and builder. The rapid railroad construction in hand and projected in the West makes it a field worth watching, especially by the younger men of energy and ability who desire to succeed through hard knocks. The outflow of Eastern capital guarantees prosperity to the far West. Hitherto progress there has been irregular and failures frequent, but since the pretty thorough development of those States confidence has been strengthened; resources have been developed; long unproductive capital has become productive, and population is crowding thither to profit by the developments that are assured to patient industry.



Lord Mansfield, Westminster Abbey, Flaxman, Sculptor.



The Byron Memorial, Hyde Park, 1879, T. Belt, Sculptor.



Thomas Carlyle, Cheyne Walk, Chelsea, Boehm, Sculptor.



James Watt, Westminister Abbey, Chantry, Sculptor.



Geo. Peabody, Royal Exchange, 1871, Story, Sculptor.

SITTING STATUES IN LONDON.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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CONTENTS

JUDGE FOOTE, of the California Supreme Court, has just rendered a decision in a suit brought to decide the liability for damage done to adjacent property by careless blasting, and not only the conclusion he reaches seems to us the proper one, but the principle he lays down seems to cover damage of any kind done to a neighboring property through improperly executed building operations of any kind, whether by blasting, undermining of party-walls, defective shoring, or whatever else. As the case, Colton *vs.* Onderdonk, was carried up from the court below, where the plaintiff got a verdict which was only slightly cut down in the Supreme Court, it is a good one to remember. In giving his opinion, Judge Foote said that the fact that the defendant had used gunpowder in blasting in a lot adjoining other buildings not belonging to him must be taken as showing that the defendant had made an "unreasonable and unnatural use of his own property, which no care or skill in so doing can excuse him from being responsible to the plaintiff for the damage he actually did to his dwelling-house as the natural and proximate result of his blasting." This does not at all mean that it is unlawful or improper to fire blasts where there is a possibility of working injury to adjoining property: it only emphasizes the fact that there are certain acts, proper and lawful enough in themselves, which are, nevertheless, inalienably connected with more or less definite risks, and that the person who performs these acts cannot be absolved by having obtained legal license, for instance, so to do from a full responsibility to the injured party for any damage he may suffer through such acts. Judge Foote goes even farther than this, and holds that "an act which in many cases is in itself lawful becomes unlawful when by it damage has accrued to the property of another." It may seem a little peculiar that a lawful act can ever become unlawful, but as any one in five minutes can think of a dozen lawful acts which are punishable at law, if they have been so unlucky as to cause damage to any one, we have no reason to doubt that the learned justice is absolutely in the right; at any rate, what he says is sensible, and, as we said, covers damages inflicted by more things than gunpowder.

THE Springfield *Republican* tells an almost unbelievable story about the great Navarro flats — the "Lisbon," the "Madrid," the "Cordova," and the "Barcelona" — in New York, which are familiar sights to all visitors to the city; unbelievable because, though one man might be careless enough to invest money in real estate without thoroughly searching the title or putting his deeds on record, it is almost incredible that half-a-dozen men accustomed to business transactions should have acted so recklessly. The tale is that Mr. Navarro, when entering on so large an undertaking, naturally had recourse to the familiar means of raising money by mortgaging the property, and obtained a million dollars in this way from the Mutual Life Insurance Company, on four first mortgages. As the buildings progressed, Mr. Navarro had need of more money, and then conceived his coöperative plan, the details of which we have given in these pages, and in return for large sums of money varying from twenty to fifty thousand dollars leased certain unfinished apartments to the gentlemen who wished to take part in his venture, allowing them to finish the apartments to suit their several fancies, and giving them ninety-nine-year leases. A clause in these leases expressly states that they are subject to existing mortgages, so that the lessees were evidently put on inquiry, and if they failed to search the titles after such a warning, or put their leases and contracts on record, they cannot complain that the present crisis could not have been foreseen. It now appears that Mr. Navarro has not properly liquidated the interest on his mortgages or paid his taxes, and the insurance company, tired of this neglect, now proposes to foreclose. It also appears that other parties interested in the property were not so oblivious of legal forms as the unfortunate lessees, for no sooner did the insurance company announce its decision than a Mr. McComb, of Dobbs Ferry, comes forward and shows that he holds recorded second and third mortgages on the property, to the amount of two million dollars. The plight of the lessees is exceedingly uncomfortable, for it is probable that the annual rental of the apartments is a nominal sum in consideration of the sum invested in the actual construction of the building, and it is hardly supposable that after foreclosure the mortgagees will be willing to renew the leases on such favorable terms, as these rents would probably not represent a fair interest on their investment. The moral is obvious.

THE enthusiasm with which committees and individuals engage in getting up exhibitions of architectural drawings is pretty sure to meet with a very shabby recompense, so far as their reward is dependent on attracting the attention of the public in its sight-seeing mood. The desolation which seems to pervade the room or section assigned to the display of architectural drawings is such that even members of the profession must feel as if they were committing sacrilege by breaking the quiet that rules over these neglected spots. People will travel miles and cross oceans to enjoy the beauties of some noted building, while they will not cross the room to look at a black-and-white drawing of it; and it is not strange that they feel so, for even architects are affected by the same feeling in a less degree. Perhaps one reason for this, so far at least as the public is concerned, is that there is missed in an exhibition of drawings all sense of scale, and hence it is impossible to get from representations on drawing-paper even the merest ghost of that awe-inspiring sensation which would steal over even uneducated minds when brought face to face with the mere bulk and enclosed space of some buildings, which if represented in an exhibition of architectural drawings would be considered as of no more significance—probably less—than the shingle palace shown in the drawing hung by its side. A stereopticon exhibition of architectural views is usually a success, for in them the sense of scale is better preserved, and can be understood by all, as witness the surprised murmur that breaks from an audience when a new slide showing some architectural monument of merit is introduced into the lantern. We suggest to the committee who have charge of the architectural exhibit for the Minneapolis Exposition, and who between now and August 15 will seek for contributions of drawings, to seek rather for photographs of executed works. If from these they will have made stereopticon slides, and install that useful instrument in a dark room in the exhibition building, we think they may feel sure that the architectural exhibit will be one of the most popular features of the exhibition: the success would be even more certain if, such is the frailty of human nature, a small entrance-fee should be charged, which would cancel or at least diminish the cost of preparing the transparencies and hiring the magic-lantern. As it might be monotonous for any one to exhibit

architectural views all day long for weeks together, it would be well to discover if an automatic attachment could not be devised for the occasion.

THE exhibition we speak of above is largely due to the efforts of the *Northwestern Architect*, and this, and the fact that the conductors of another journal, the *American Builder*, are engaged in getting together an exhibition of a little different kind, seem to show that the professional journals are part and parcel of the profession and vital forces in promoting its interests wherever occasion seems to offer. The *American Builder* is interested in creating a permanent exhibition of building materials at Cleveland, after the manner of the one in Chicago, and its imitator at St. Paul. The Cleveland enterprise is none the less legitimate, because it is probably more a money-making than a philanthropic venture, but while its novelty is still unfaded it will be of some real service to those who are engaged in building, whether architects, builders oi owners. It will take much ingenuity on the part of the managers to keep it from becoming, in course of time, merely a dust-colored and much-neglected collection of commodities, which have in their detached and unapplied forms almost no attraction for the general public.

IF there is really to be an American exhibition in London next year, of which we confess we are somewhat doubtful, we hope that it will be a success. It is about two years since this exhibition was announced, and during that time manufacturers and newspapers in this country have received from the projectors many and various printed documents, which con sisted mainly of lists of officials — largely honorary nonworkers who happened to have titles to commend them — the names of a few American manufacturers who had promised to send exhibits, sketches of the careers of the active promoters of the undertaking, illustrated sometimes by their portraits, and more or less mythical statements as to the ground secured for the exhibition and the plans of the buildings in which it was to be held. We call them "mythical," for about a year ago inquiries were made of their English correspondents, by certain Americans who thought of preparing goods for show, which elicited the statements that no one in London knew anything of the affair, and that the site said to be secured for the exhibition had not been leased for any such purpose. Furthermore, when some months ago it was rumored that President Cleveland had accepted the presidency of the stock company which is supposed to have the matter in charge, one of the leading New York papers published a long letter of remonstrance from a correspondent, who said Mr. Cleveland could not have known what kind of men he was consenting to associate with, and then proceeded to give the history of some of the promoters. Since that time we have seen it stated that Mr. Washburn was to be the president, and now we see that Mr. Goshorn, the chief director of the Centennial Exhibition is to act in that capacity. The latest "address" issued by the directors states that the exhibition is to be opened May 2, 1887, and urges American manufacturers to bestir themselves. We will not go so far as to say that the exhibition will not take place, but we do advise intending exhibitors to make careful inquiries of disinterested correspondents in England before they assume the risk of preparing and despatching their exhibits; for even if everything is all right it is to be remembered that this "Yankeries," as we have seen it styled, is a purely private undertaking, without government support or recognition, and exhibitors must count on having to bear the cost of sending their goods to London unaided, and in like manner getting them back again. The idea of such an exhibition is in many ways good, and it might — and may — turn out both interesting and successful, and if it should prove to be so we will both rejoice and confess that our present foreboding that the matter is not in the hands of the right kind of men was foundationless.

THE matter of underground electric wires seems just now to excite more interest than any other. Cincinnati is considering the question, and has a committee whlch is examining the merits of the different systems. In that city an unusual obstacle will have to be overcome: during the present season the city is spending several million dollars in repaving the streets with granite blocks, and not only are the authorities a little unwilling to have their work undone so soon and the fair level of the roadway injured, but the citizens may reasonably feel that they have been subjected to enough annoyance for one year through the interruption of traffic. It seems as if the proper thing would be to suspend at once all further paving work until an underground electric system had been selected, so that both operations could be carried on at once in the streets which are yet to be repaved. In the matter of the New York electric subways there seems a promise of lively times if half that the newspapers report is true. The New York *Times* is particularly active in trying to find out the inner meaning of the peculiar letting of the contract, and thinks it has discovered first that the Consolidated Telegraph and Electric Subway Company was at the time the contract was awarded practically an organization as yet unborn: next that a man named Flynn, a son-in-law of one of the Subway Commissioners, was likely to be a large gainer as a reward for his occult engineering of the contract into the hands of his associate; next that the Bell Telephone Company is likely to appear in the consolidation as the provider of the capital, and that hence rival monopolies, large or small, may expect small favor at its hands, and, lastly, that the Western Union will probably resist the mandate of the Subway Commission on the ground that the act under which they receive their power is unconstitutional; and that, furthermore, the Western Union had the prevision to spend forty thousand dollars at the time the act was in preparation for the sake of having the act so mis-drawn that it should be unconstitutional. That the Western Union and other corporations, which have fairly vested rights in poles and other apparatus, which they maintain are taxed as real estate, will resist as long as possible can easily be believed, but it is impossible not to feel assured that in the end all wires will be put under ground, whether in accordance with the present act, or some other one drawn with all necessary care.

CONJECTURE, inference and imagination play such important rôles in the discoveries made by learned archæologists that it is easy to see why there are so many differences of opinion arising between the doctors of the dusty craft, and such hot discussions brought under the eyes of the public, who cannot help wondering why such intemperate language should be used in arguing over such ridiculously unimportant matters. The course of archæological investigation is usually this: an investigator makes certain discoveries, records his facts and formulates his theories; immediately after he leaves the field other archæologists visit the new "finds" and prove to their own satisfaction that the theories of the original discoverer are all wrong, and that the facts, if correctly stated at first, really support vastly different hypotheses. The only way of obviating these unpleasant disputes seems to be for archæologists to hunt in couples or companies, and settle their disputes on the spot. A case in point is that of the Royal Tombs at Mycenæ, which Dr. Schliemann, the original discoverer, believed to be the sepulchres of the Achæan Princes before the time of Agamemnon, but which Mr. Stillman, who visited them later, feels convinced are merely Celtic graves, of the third century before Christ, basing his argument on the character of the masonry. A later visitor, Professor W. W. Goodwin, of Harvard College, feels assured however, that the true date of the masonry is A. D. 1879; for he discovered that directly after Dr. Schliemann had left Mycenæ, and before Mr. Stillman visited it, the Greek laborers who had been employed in the excavations *had taken down every stone* used in the tombs in the search for treasures that had escaped the anxious eye of Dr. Schliemann, and that they had afterwards attempted to rebuild them as they were originally. It is not surprising that the character given by them to the masonry deceived Mr. Stillman, but it does seem strange that he should have overlooked the presence of freshly-split stones in the wall which Professor Goodwin, who does not profess to be anything more than a student of Greek literature, at once discovered. So there seems to be no reason for discrediting the description and the measured drawings of Dr. Schliemann. This incident seems to show that succeeding observers of an archæological discovery may be easily misled, and that if the original discoverer wishes to have his descriptions uncontradicted he must support them by the evidence which can only be furnished by the camera, a measuring-rod being introduced in each view.

AN EDITOR'S TRIP ABROAD.[1] — VI.

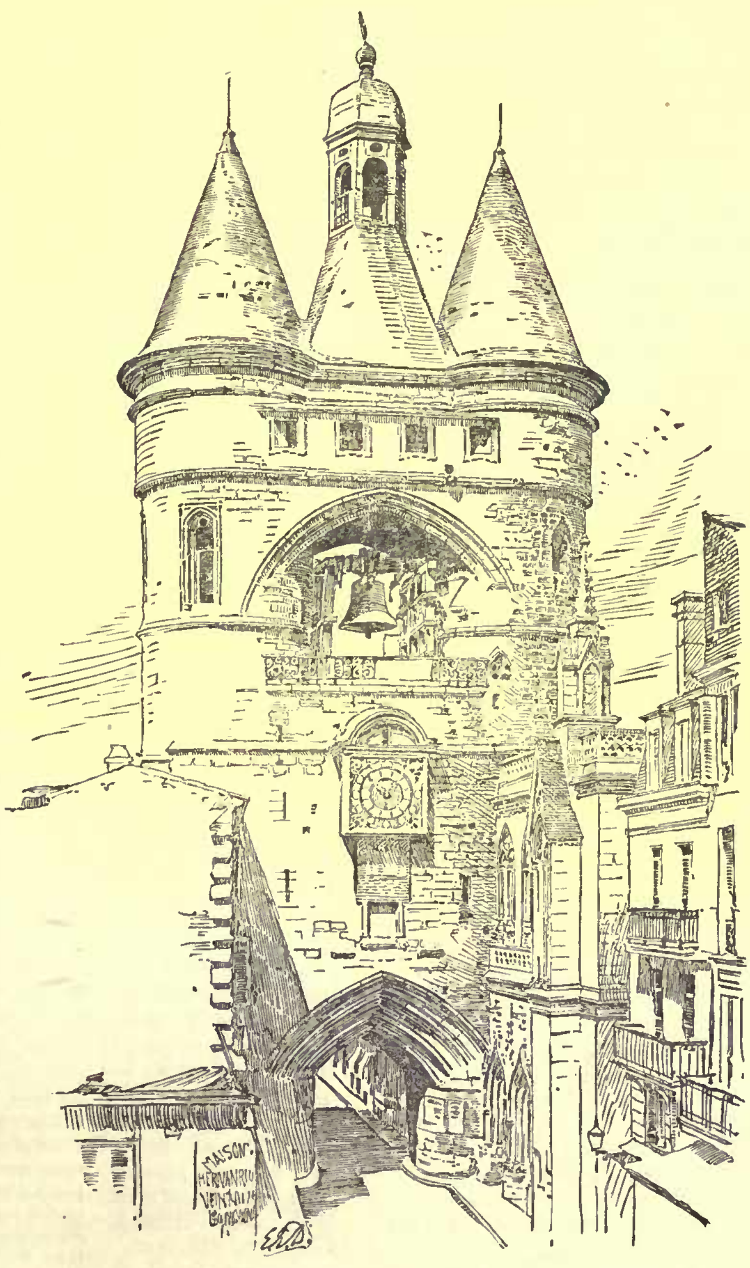
PISE WORK ABOUT LYONS. — SEMI-TROPICAL VERDURE ABOUT MARSEILLES. — NORTHERN ITALY.



I DOUBT if any ride of similar length affords greater interest to the unambitious architectural mind than that from Paris to Genoa, through Lyons and Marseilles. By taking the "*rapide*" train, which leaves Paris at a comfortable hour in the morning, and stopping over for the night at Lyons, Marseilles and Nice, the whole journey can be made by daylight, and most of it in "*omnibus*" trains, which are as much superior to express trains for observing the country which they pass through as a stage-coach would be superior to them, if any such mode of transportation were available. It would be difficult to say too much of the picturesqueness of the farm-houses and villages of Picardy, which seemed to me to have a flavor much more quaint and delicate than those of Normandy; but in the journey from Paris to Italy, by the Mediterranean coast, the character of the humbler sort of architecture changes almost with every hour, according to the variations of the climate and the peculiarities of the local population. Starting from Paris, and passing through Melun and Fontainebleau, one sees a great deal of the prettiest suburban work to be found anywhere around the city, and as this gradually disappears, its place is taken by the beautifully stylish and artistic domestic building to which the good materials supplied by the Burgundian hills seem to have given a motive, varied by glimpses of more important architecture at Sens, Joigny, Tonnerre, Dijon and a dozen other places. As the train approaches Lyons, the eye of the practical man is struck by the occasional appearance of roofs covered with curved tiles, after the Italian fashion, instead of the plain flat ones, or those with a sort of standing-seam joint, which had previously been the only sort used. The curved tiles, although they are cheap and shed rain well enough, leave so many openings for wind and snow that I was surprised to see them used in a climate so far from mild as that of the region about Lyons, but it appeared on further examination that those on dwelling-houses were pointed up tight with mortar. The washings from the mortar gave these roofs a streaky, stony look that pleased me very much, and some of them were even purposely whitewashed all over, giving the house to which they belonged the appearance of a limestone boulder.

About Lyons itself there is not much good building stone, and walls of *pisé*, or tempered loam, began to occur not far from Macon. The first examples were mostly garden enclosures, but houses, two three, and even four stories high, built of the same material, soon appeared. It was easy to distinguish them by the alternating oblique lines of the joints caused by the shifting of the boxes or frames in which the *pisé* is made, as well as by the traces of the pointing employed to fill up the holes left by the cross-sticks, which hold the frames and are pulled out of the wall when these are shifted. In most cases the wall was left of the natural color of the yellowish loam, varied by the lighter streaks of the mud joints, but some of the houses were whitewashed over all. No precautions against dampness or rain seemed to be taken, except to begin the walls on a course of pebbles, to keep them a little off the ground, and to protect the top by projecting eaves of some kind, the garden walls having little tile roofs over their whole length. In some new houses the floor beams appeared to be built in after the manner usual with masonry, but there were probably flat stones or timbers under the ends, to distribute the weight. The thickness of the walls did not seem to be greater than that which we should give to a wall of rubble-stone under similar circumstances, but I did not see a single example which looked cracked or badly decayed. It has often been suggested that this sort of construction would be well adapted for our own Mississippi Valley, where loam is abundant, and stone and wood and skilled labor scarce, and there seems to be no reason why it should not answer as well for Iowa and Mississippi as for the district about Lyons.

On leaving Lyons for Marseilles, the symptoms of a change in climate begin to multiply rapidly. One of the most marked of these is the lowering of the pitch of the roofs, which take on an Italian aspect very different from that of the Northern buildings. Stone soon begins to be used again, but more and more after the Italian fashion of plastered rubble, walls of cut-stone appearing only in the handsomer houses, and in the churches and the old castles, which are here so numerous that one or two, at least, are almost always in sight from the train. Most of the castles seemed to me to be different in style from those which we had seen north of Lyons. There were fewer round towers, and the buildings were not only better preserved, but usually much more extensive than the others. At Montélimar, Orange and Avignon, particularly, were vast and picturesque ruins, while at Tarascon were two huge castles, threatening each other from opposite sides of the river. At Orange and Arles the first Roman remains came into view, in the shape of rows of great semi-circular brick arches, standing apparently at random in the modern streets; and at about the same point occasional small olive-trees, with gray, willow-like foliage, began to vary the monotony of the endless vineyards, which occupy the ground, almost to the exclusion of everything else, for five hundred miles, from the neighborhood of Paris to the point where all vegetation disappears in the stony plain which forms the approach to Marseilles.



Gateway at Bordeaux, France.

At Marseilles, although the city itself presented nothing more than streets of rather handsome houses of plastered rubble, the parks and squares had a sort of semi-tropical look, to which we were quite unaccustomed. It is quite likely that there, as in Richmond and Washington, some effort is made, for the sake of novelty, to cultivate trees which endure the climate only with difficulty, and some of the palm-trees in the gardens looked as if they had led a hard life, but, although stunted and brown, they were real palm-trees, and mingled among them were hundreds of oleander-trees, fifteen to twenty feet high, covered with pink and red and white flowers, with here and there a great magnolia in full bloom. The next morning, however, as we moved eastward from Marseilles into the shelter of the mountains which protect the Riviera from the north wind, the aspect of the country changed rapidly, and at Fréjus, not many miles from Marseilles, we saw for the first time a natural and unprotected date-palm tree, some sixty feet high, standing in the back-yard of a cottage near the station. This was the precursor of thousands more, and from Fréjus to Nice the hillside villages along the coast were literally buried in palms and oleanders, orange and lemon trees, grape-vines,

[1] Continued from page 41, No. 552.

olive-trees and flowers. Of the latter, the various sorts of geranium were most conspicuous. The double scarlet and pink geraniums seemed to be mere weeds, masses of them, in full flower, growing on the railroad embankments, hanging over the retaining-walls of the terraced orchards and vineyards, or growing out of the "weep-holes" in the masonry, and a climber with large pink flowers, and another with a profusion of blue flowers, covered a considerable part of the spaces which the geraniums left vacant, while here and there a little variety was given by masses of scarlet trumpet-flowers, or by blue passion-flowers, with which one little station was nearly covered. The oranges were in some places nearly ripe, and showed, as did some that we bought at Lyons, a reddish blush, like that of an apple, on the sunny side.

As might be expected, the change in climate from France to Italy was accompanied with a decided change in the character of the buildings along the shore. Here and there some new city of villas and hotels, like Cannes, or Nice, or Mentone, would dazzle one's eyes with its pink and yellow and white stuccoed walls, but the older towns were masses of tall houses that had once been white, crowded along narrow streets, and pieced out and connected together with all those arches and flying buttresses and corbellings which so delight the architect's heart in Italy. After leaving Nice, near which the traveller on the railway gets a near view of Garnier's rather unsuccessful building for the Monte Carlo gambling-house, the little towns acquire, perhaps, a still stronger Italian flavor from the more frequent introduction of fresco decoration on the plastered exterior surface. The commonest subject is a Raphaelesque Madonna, or saint of some kind, generally accompanied by other figures and enclosed in a blue border, painted near the front door, apparently as a sort of dedication of the house to Christian domesticity. There was not much originality about the pictures that we saw, a large part of them having very evidently appropriated their composition bodily from the Sistine Madonna; but some were executed with no mean skill, and it was rather pleasant to observe that they were usually placed under a balcony or shelter of some kind, and were carefully looked after, many having flowers hung up about them.

Naturally enough, a community so piously inclined is provided with plenty of churches, old and new. Of these the former interested me most, but there were some extremely pretty new ones, built in a rather lighter style than that of their predecessors, and proportioned and colored with admirable taste. One, in particular, of very simple construction, possessed a beautiful tower, square in plan for about sixty feet from the ground, and pierced only for the door and for four plain, round-arched windows, the heads of which were about forty-five feet from the ground. This portion was terminated by a projecting balcony, with stone corbelling and platform and iron railing, and above this was a square second story, having a large round-arched opening on each side, with moulded archivolt, and moulded impost extending around each pier; then came a moulded cornice of slight projection, and above all an octagonal story, with round-arched windows in the alternate sides, and small archivolt and impost mouldings and an octagonal semi-dome roof. The roof was apparently a real stone dome, but was covered with red tiles. The base of the dome, and all the horizontal mouldings and archivolts, and the corbelling under the balcony, were painted white, and the remaining surfaces green, of a light, chalky shade that suited the surroundings perfectly. Among the old buildings, one of the most curious and effective was at San Lorenzo, where there was a church of considerable size, with nave, aisles and transepts, situated near the west end of the church, an octagonal tower over the crossing, and a semicircular apse, with a tower, as seemed to be most common in this region, situated at the end of the north aisle, a little distance from the apse. The nave and aisles, as in all the other churches in the vicinity, were covered with a continuous roof of low pitch, and the same was carried over the transepts, the projection of which beyond the exterior aisle wall was semi-circular, giving a singular air to that end of the building, but helping greatly the effect of the low dome, which would have been completely extinguished by ordinary transept gables.

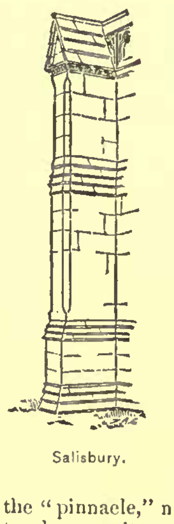
Fixtures and Personal Property.—An engine, boiler, and certain machinery were claimed as personal property by one party and as fixtures by another. A shed, opening only into the factory, had been built over the engine and boiler, and the latter rested on a brick ash-box, while the machinery was partly nailed and partly screwed to the floor. The master to whom the matter was referred found the articles to be personal property, not fixtures; and the case being carried up on appeal, this decision was sustained. Judge Holmes in his opinion said: "Perhaps it would have saved perplexing questions if the rule of the common law had been more strictly adhered to, that whatever is annexed to the freehold by the owner becomes a part of the realty and passes by a conveyance of it. The right of a tenant to sever chattels which he has attached to the realty might be admitted, and yet the property might be regarded as land until severed, as it seems to be in England. The decisions of this State [Massachusetts] establish that machinery may remain chattels for all purposes, even though physically attached to the freehold by the owner, if the mode of attachment indicates that it is merely to steady them for their more convenient use, and not to make them an adjunct of the building or soil. We see no ground to interfere with the finding of the master in this case. This property is not at all necessarily to be considered fixtures."—(*Carpenter vs. Walker; Supreme Judicial Court of Massachusetts.*)

CONSTRUCTION THE ORIGIN OF ARCHITECTURAL DETAILS.[1]— II.

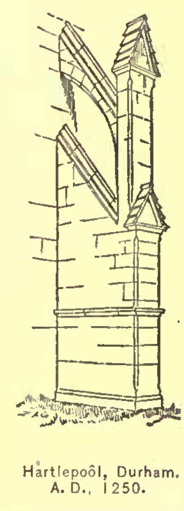


Warboys, Lincolnshire.

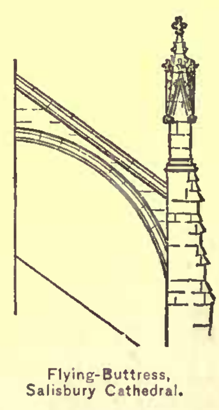
In connection with piers and buttresses there is another feature very pertinent to our subject. Here we have a mass of stone gradually diminishing, it is true, as it approaches the point where it connects with the springer of the vaults. Great strength is required certainly, but are we sure that we have not got more material than we need. There are stones upon stones which appear to have no other duty than to give a minute portion of their own strength to support other stones which actually do the work of resisting the thrusting vaults. Could we not arrange the really active stones in some such manner that they may support each other, and still give the requisite support to the roof, and do away with those stones which do little to contribute necessary strength, and beyond that only take up a great deal of space. This idea was put into practice, and with the greatest success. The upper part of the buttresses was constructed on the principle of a half arch, transmitting the thrust to the lower part, leaving a space beneath it, formerly occupied by a great bulk of masonry—that has now been found to be unnecessary—to be turned into an aisle or chapel, to be walled and roofed in as circumstances might suggest, and made a part of the interior of the edifice. Again, there is a further way of reducing the mass at the base of these new flying-buttresses: they can be cut down on the outside, as well as on the inside, but with this proviso, as in each other case, that if we remove the material from a vital part, we must put it somewhere else, or give an equivalent for it. The tendency of the flying-buttress is to spring or "kick out" at its foot, and to resist this, weight is required at the top of the buttress proper. If we take away the solid gable, we must introduce another feature, viz.:



Salisbury.

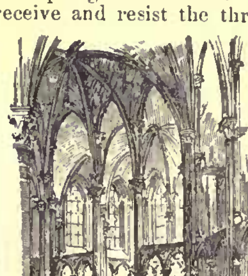


Hartlepool, Durham. A. D., 1250.



Flying-Buttress, Salisbury Cathedral.

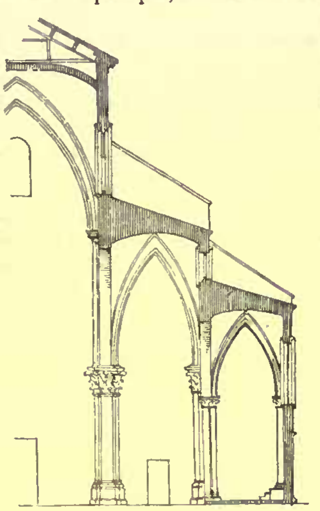
the "pinnacle," not as an ornament in the first place, but as a structural necessity. A very beautiful feature about the chancel of a cathedral is that arrangement of chapels known by the term "*chevet*." Here is a semi-octagonal apse, from every angle of which on the inside springs a rib of the vaulting. On the outside are buttresses to receive and resist the thrust of these ribs, radiating on plan from the centre of the octagon, and as they recede from the chancel walls, of course the spaces between them widen. A happy thought occurred to some one about the end of the ninth century, and that was to enclose and roof over this space and thus form small chambers or chapels, one to each side of the semi-octagon. This is a well-known feature, affording an endless variety of combinations of curves of the arches, set off and enhanced by the upright lines of the piers, that rise above and are carried up to the springing of the vaults. Here we have such a play of light and shade that we doubt whether any other arrangement exists in the whole world of design that can surpass this for beauty and effect. The origin of this was a construction and arrangement of buttresses, which grew as a matter of necessity, and the architects did but take it as it was and made the best of it. The buttresses were not so arranged for the sake of putting chapels between them, but the chapels were the afterthought.



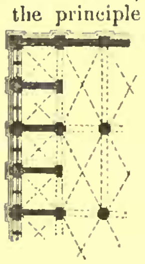
Auxerra.

[1] By R. W. Gambier-Bousfield. Continued from No. 552, page 40.

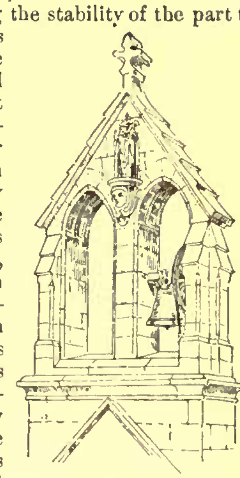
We must call attention to another detail of very common occurrence, and this is in connection with towers and spires; viz., the method of changing from a square tower to an octagonal spire. To set such a spire on the top of a square tower abruptly is decidedly undignified and ungraceful in result, and seems to need some further detail, such as a parapet to hide the junction. This was constantly employed, and the plan of the spire was considerably smaller at the base than the square of the tower, so as to leave a passage between it and the parapet, but where the octagon is of the same diameter as the tower, a gradual change, as shown in the initial cut, seems to carry the eye from ground to summit without any abrupt interruption, and the two totally distinct forms are made one and indivisible. And this, again, is not a mere fancy of the designers, but a useful piece of construction. In the same connection is another and even more scientific detail, somewhat akin to the principle of the pinnacle. This is specially noticeable in the spire of Chichester Cathedral, although there are innumerable examples both in cathedral and parish churches. At the junction of towers and spires are very beautiful canopies supported by slender shafts, rising in some cases over twenty feet in height. The feet of these shafts rest on the outer lower edge of the spire, while the shafts themselves rise perpendicularly, and as the sides of the spire recede towards the apex, the space between the two gradually widens, until at the roof there is a space of several feet. Sometimes the space between the shafts is filled in with masonry and pierced with windows, to give light to the interior of the spire, but often it is left open, and appears to be nothing more nor less than a niche. This charming feature, graceful and beautiful in the extreme, instead of being a useless ornament, is a *structural necessity*. It is the main-stay and prop of the superstructure, and its weight is sufficient to counteract the outward thrust of the sloping sides of the spire. This is its office and function, and for this purpose was it introduced.



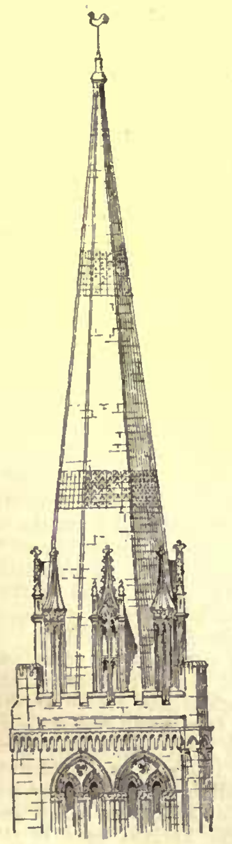
S. Petronio, Bologna. — Solid buttresses forming chapel walls.



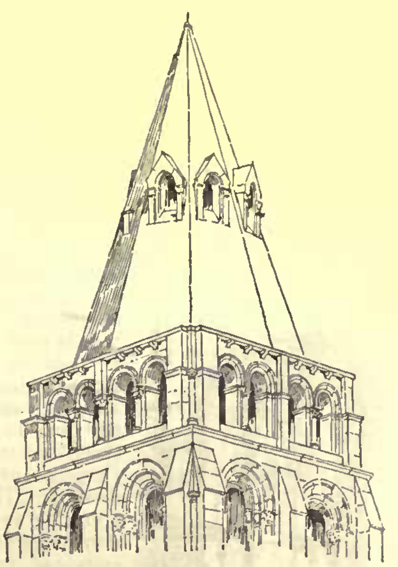
In many small country churches one often sees a bell-turret erected somewhere above the roof, where no spire or tower exists. But although this cannot claim a place as a structural necessity, yet it is a good example of the treatment of a requirement or practical need. It was necessary to have bells outside the church, where the building itself would not interfere with the spread of the waves of sound, and if placed high up in an exposed position, they must have strong supports; and while we are about it we may as well give them some protection from the inclemency of the weather. So we have here a detail which has many charms in itself, arising from a social requirement, not stuck up in so conspicuous a position because it happened to be a good place for a prominent feature, but because no other place would be so suitable for the attainment of the object in view. And we see that this is not a piece of constructed ornament, but ornamented and ornamental construction. Not only in large details is the truth of the art demonstrated, but, look where we will, we may find examples in the simplest forms. Take, for instance, any cap or base: there is the bell-line in each, into which no hollows must be cut, not merely because it gives an appearance of weakness, which is unsatisfactory, but because it is actually a weakening of the bearing powers of the cap or base. When a superincumbent weight is to be supported by some figure of much less area than itself, the diminution from the one to the other must be gradual, more or less so, according to the material used; if otherwise, we should have an actual fault in construction, seriously endangering the stability of the part to be supported. So the form of our caps has some other consideration in it than mere constructed ornament. An ornamental piece of construction is a boss, placed at the intersection of the ribs of a vaulted ceiling. Sometimes these ribs come together from different angles, and their junction in such cases is not pleasing. That they must meet, and meet pretty much where and as they like, goes without saying, as our arches in vaulting must be complete, and, to say the least of it, the introduction of a boss here decidedly improves the appearance, and the junction or intersection of the ribs is thus emphasized. The labels or drip-moulds over the heads of windows have their origin in necessity. It was required to keep from the window the flow of water, caused by the rain down the walls, and the simplest way to do this was to put some projection above, that would stop the water and make it drip off without touching the window itself. These labels are treated with all kinds of elaboration, but they remain drips throughout, and they take their place as an example of ornamented construction.



Glastonbury.



Chichester Canopies end Pinnacles Thrent.

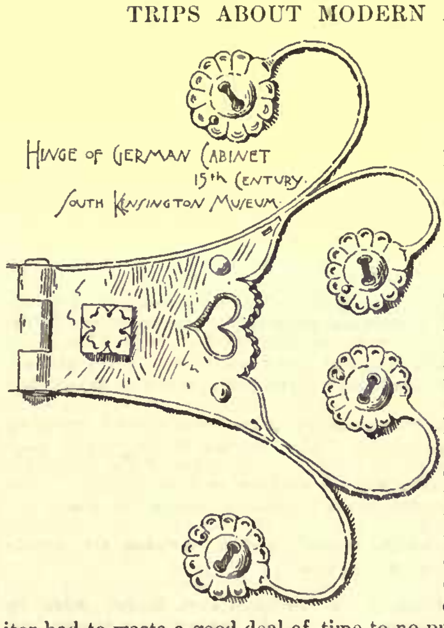


Cormery.

Before concluding, we would remark that there is no greater fallacy in design than the idea that an ornament may be clapped on, to cover some ugly piece of construction. To do this is to make your ornament a lie and a veil for deceit. If you have some plain surface, that if ornamented would improve the appearance of the whole building, by all means put some suitable ornament there, but let it be seen that it is an ornament, pure and simple, but don't try to work things about it, so that it may appear to be a necessity of construction. Let your building be truth in itself in every particular, and your ornament that kind of decoration which only enhances and emphasizes the truth, and you will be proving over and over again the divine origin of your art, and in every detail you will stand as a champion for her defense against the vandalism and extravagance of that common fiend "Sham."

> "Oh, gather whereso'er ye safely may,
> The help which slackening piety requires,
> Nor deem that he, perforce, must go astray
> Who treads upon the footmarks of his sires."
>
> —*Wordsworth.*

TRIPS ABOUT MODERN ATHENS.



TRAVELLERS who stayed at Athens for a few days a couple of years ago could see comparatively little. They were obliged to content themselves with visiting the remains of antiquity in the city, and had barely time left to inspect some of those in the immediate neighborhood. The limitation of days and hours on which the ruins were open to inspection — the Acropolis and the museum of the Acropolis not excepted — was made more troublesome by the scattering of the museums, which were only shown on certain days of the week; and even in the city the visitor had to waste a good deal of time to no purpose. Of excursions into the neighborhood to Marathon, Pentelicus, Eleusis, Sunium, Ægina, the traveller who was pressed for time could attempt few, and, of course, he could not indulge in expeditions to Corinth, Nemea, Tiryns, or Mycenæ; they involved a rather lengthy journey or a fatiguing ride. It deserves to be mentioned that now, through the

improvement of the organization of the museums and the improvement in the means of communication, a visit to Athens has become much better worth paying since, even if the tourist's sojourn be limited, he can make excursions as far as Mycenæ and Tiryns at a cheap rate. A visit to Eleusis no longer requires a whole day and a carriage drive of eight long hours there and back. The railway from Athens to Patras, which will soon be open to Ægium, and is already in working order as far as Sicyon, conveys the traveller to Eleusis in an hour. The visit to the sanctuary of Ceres and the recent excavations occupies a forenoon agreeably, and the railway journey only costs half a crown. In an hour after passing Eleusis the train reaches Megara, and in an hour and a half more Corinth, after passing the interesting precipices of the Scironian Rocks. At an hour's distance from Corinth the line reaches the beautiful and vine-clad Kiato, whence an easy ride of some three-quarters of an hour brings the traveller to the ruins of the ancient Sicyon, at the modern village of Wassiliko. By another branch of the same railway the tourist gets from Corinth to Nauplia in three hours. By this branch four sites of great historical interest are brought within a manageable distance of Athens — I mean Nemea, Mycenæ, Argos, and Tiryns. In the so-called little tour of the Peloponnesus one used to spend at least four days in visiting these localities, now they can be much more conveniently seen in less than two days. The journey from Athens to Mycenæ takes six hours. One can leave Athens quite early in the morning, breakfast at Corinth, and in two more hours reach the station of Phichtia. From this village it is a ride of three-quarters of an hour to the Treasury and the Acropolis of the Atreidæ. The station Nemea is on the line from Corinth to Phichtia, and is only twenty minutes distant from the latter place. Argos is only five-and-twenty minutes from Nemea. Tiryns is reached in a train in twenty minutes from Argos, but in ten from Nauplia. All these places, therefore, are not only brought nearer to Athens, but close to one another. The sights of the ancient civilization of Argolis are, through the revolution in modern communications, more quickly compared, and, so to say, more correctly comprehended. As the railway to Nauplia has only been in operation for a month, it is obvious that all the requirements of the tourists are not yet provided for at the station of Phichtia. No horses are to be found there in readiness for the ride to Mycenæ. A carriage-road is already talked of on all hands, and, as it could be easily made, it will, it is hoped, be ready before long. From the opening of a carriage-road to the starting of a hotel in the neighborhood of the ruins of Mycenæ is only a step. One has already been begun at Nemea. At Tiryns, owing to its nearness to Nauplia, there is no need of one.

On the other side, the railway from Athens to Laurium makes the district accessible to archæologists. In half an hour Cephissia is reached, and this favorite place of Herodes Atticus and Aulus, which contains the supposed sarcophagus of the former can be easily visited. In less than three hours the country between Athens and Laurium is traversed, which is interesting for its historical associations and for its mines. When on this excursion the stranger can conveniently visit the ruins of the ancient Thoricus, but the most attractive expedition is that to the Temple of Athene at Sunium, which can now be reached in two hours and a half. So the traveller who is in a hurry may leave Athens late in the afternoon, reach Laurium in the evening, see the miners at work under the electric light, on the following morning go to Sunium, lunch there, visit Thoricus, and return to Athens by eight o'clock in the evening.

The delightful excursion to the summit of Pentelicus, which most tourists make in order to view from there the plain of Marathon and the Athenian plain at sunrise, has been much facilitated by the Cephissia railway. It is now possible to spend the night comfortably at Cephissia and thence start on horseback some two hours before sunrise. Finally the tramways offer easy access to the immediate environs of Athens. The Hill of Colonus and the tombs of Lenormant and Carl Ottfried Müller may be reached in ten minutes ride from the city by taking the tramway from the Place de Concorde to Colocynthia.—*Athenæum.*

The Illustrations

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

HOUSES OF MRS. W. H. VANDERBILT AND MRS. E. F. SHEPARD, FIFTH AVE., NEW YORK. MESSRS. ATWOOD, SNOOK AND HERTER BROS., ARCHITECTS, NEW YORK, N. Y.

[Gelatine print issued only with the Imperial and Gelatine editions.]

THE CASTELLO SAN ANGELO, ROME, ITALY. AFTER AN ETCHING BY M. LUCIEN GAUTIER.

UNTIL the seige of Rome by the Goths, A. D. 537, what is now known as the Castello San Angelo had been the tomb of its creator, the Emperor Hadrian, and of his successors down to Septimus Severus. The original structure was a marble-covered cylinder, about two hundred and forty feet in diameter, standing upon a substructure about three hundred and forty-two feet square. It is not known surely how the composition above the central cylinder was finished, but the total height is thought to have been about one hundred and sixty-five feet. During the seige of 537, the tomb was used as a fortress by the hardly-beset citizens, and the statues which surmounted the main cornice, and probably the materials used in the superstructure, whatever this may have been, were thrown down by them upon the heads of the besiegers. From 923 A. D. to the present time the Tomb of Hadrian has been used as a fortress by whatever party, secular or ecclesiastic, may at the time have been in the ascendant, and it has borne a part in many revolutions and seiges.

COMPETITIVE DESIGNS FOR A $5,000 HOUSE, SUBMITTED BY "*Bowlder*" AND "*Hilltop.*"

FOR comments of the jury on these designs, see elsewhere in this issue.

COMPETITIVE DESIGN FOR A TWO-STORY CHURCH, NEWTON, MASS. MR. C. H. WALKER, ARCHITECT, BOSTON, MASS.

THE church was to have Sunday-school rooms, library, ladies' parlor, kitchen, etc., on ground floor, and church above to seat six hundred and fifty. Material, Rockport seam-face granite, trimmed with Dedham granite. Estimated cost, without heating, $38,000.

A SCHOOL-HOUSE, MOBERLY, MO. MESSRS. RAMSEY & SWASEY, ARCHITECTS, ST. LOUIS, MO.

THE front gable is timbered work with cement plaster, the bay and ventilator of copper, the walls of St. Louis pressed brick, and Euclid stone for the base and sills. The building will cost $10,000, exclusive of school furniture and furnace.

SKETCH FOR A COUNTRY-HOUSE. MR. E. T. MACAULAY, ARCHITECT, ELMIRA, N. Y.

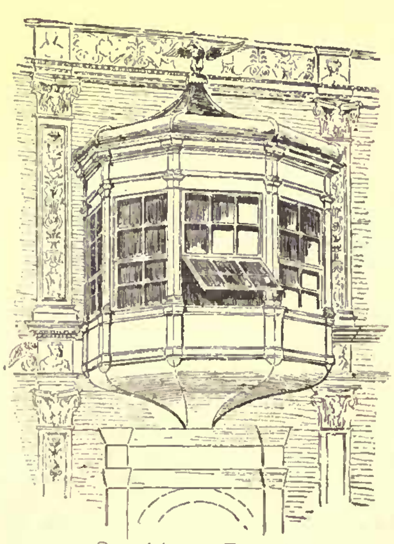
AMERICAN ARCHITECT COMPETITION FOR HOUSE COSTING $5,000.[1] — III.

"*BOWLDER.*" — The novelist is not isolated. Dining-room is too narrow. Second-story plan is good. Interior details are hurried in drawing, but with good ideas. Exterior is good, better than it seems in the drawing. Staircase-window coming as it does between two porches and with sills stepping up with the stairs makes the wall look spotty. Windows stepped in this way are very seldom good: their sills follow a diagonal line which harmonizes with nothing else. The design is simple in mass and with sufficient shadows. Rendering is uncertain, though not bad in general effect.

"*Hilltop.*" — No necessity for winter kitchen and laundry. Waste room in hall. Novelist is isolated. Details are good. The use of shingles in an interior is one among many attempts at novelty which belong in the same category with rustic staircases, green-slag mantle facings, etc., that is, wherever a crude material fitted either for defence against weather, or else to be used amongst materials equally unwrought, is brought within doors, near the eye, and in direct contrast with well-finished surfaces. Exterior is of good design except dormers, which are not sufficiently dignified for rest of house and in perspective are out of scale with it. The porch does not combine with house-wall: it seems merely to adhere to it. Rendering good.

[To be continued.]

KANSAS CITY EXCHANGE COMPETITION.



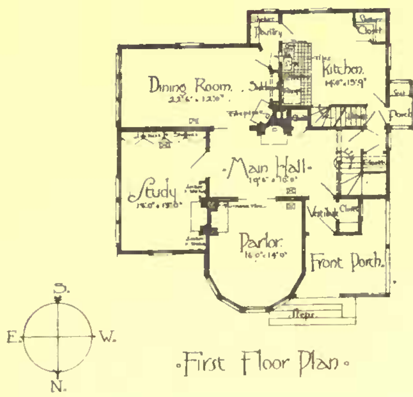
ORIEL WINDOW. FARARA ITALY
AFTER SKETCH BY J. VACHER.
A A SKETCH BOOK. LONDON.

IN fulfilment of the promise made in the printed *Instructions* issued to the competitors, we present for their information this account of the results of the Competition.

Fifty-three designs for the Exchange Building were sent in on the 15th of June. Of these, ten admitted light and air by means of several small areas or wells, twenty-five mainly by a large area at the back, six by a large area at the front, the building occupying three sides of an open court, and nine by a large court in the middle of the building which in two of the designs was covered by a skylight.

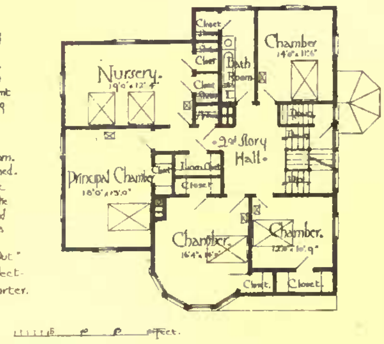
The Large Hall for the Board of Trade occupied in one design the basement, the first, second and third floors; in three, the first, second and third floors; in eighteen, the second and third floors; in seven, the second, third and fourth floors;

[1] Continued from page 42, No. 552.



-First Floor Plan-

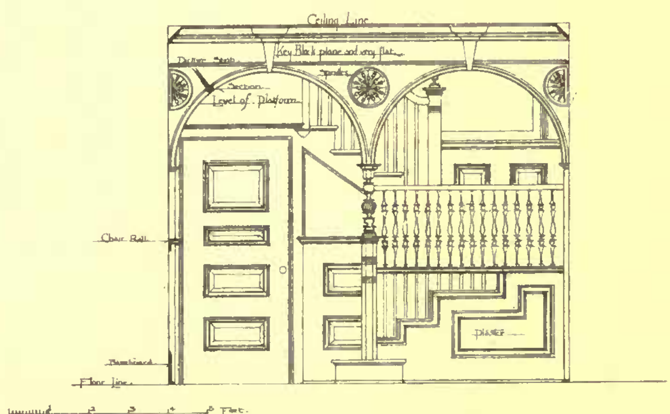
Note:
The Basement is divided into Laundry, Furnace Room and Store Room. A Water Closet will also be in Basement. The fresh air inlet will be on West side. The Water Supply is taken from Cistern which is situated in Basement under the Kitchen. The Leaching Cesspool is to be situated 100 feet from House on East side.
The Attic is divided into a Chamber and Childrens' Play Room. The remainder being left unfinished. The Water Tank is also in Attic just behind chimney and over the Bath Room. The space around the 10" iron pipe (furnace flue) is to be used for ventilation.
Bricks used in "Topping Out" of Chimneys to be "selected", and laid in red morter.



-Second Floor Plan-

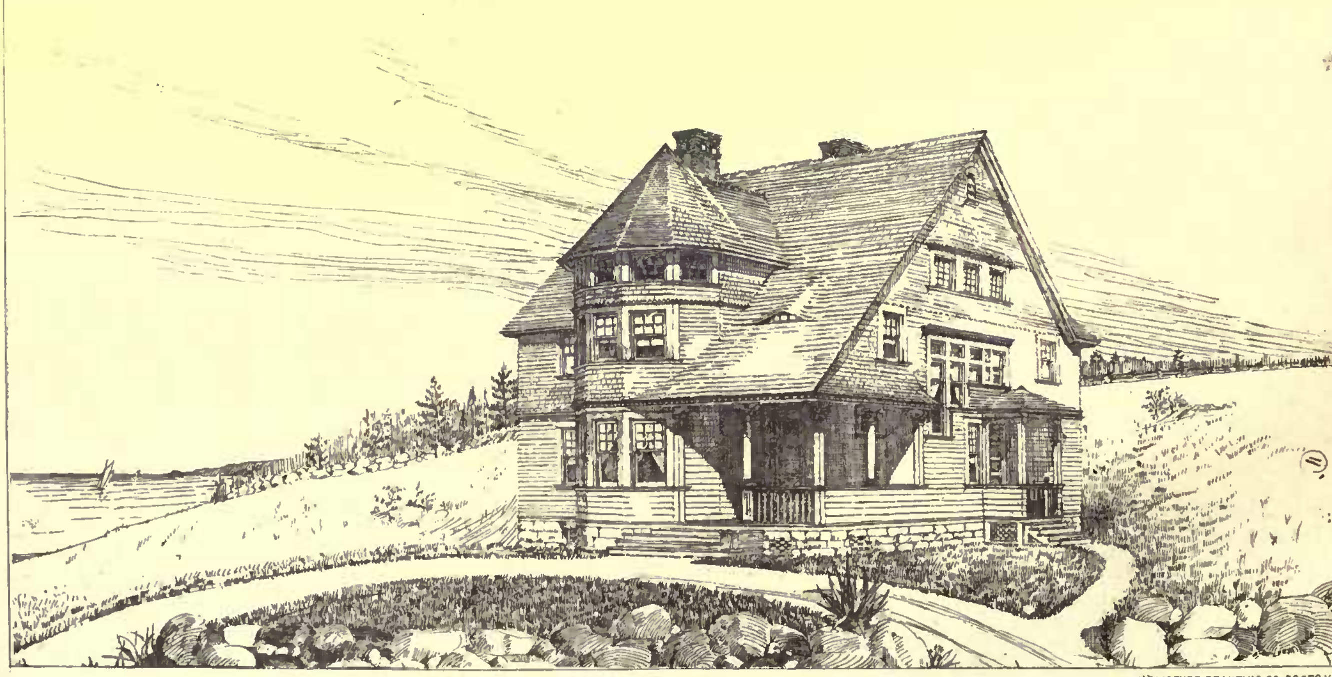


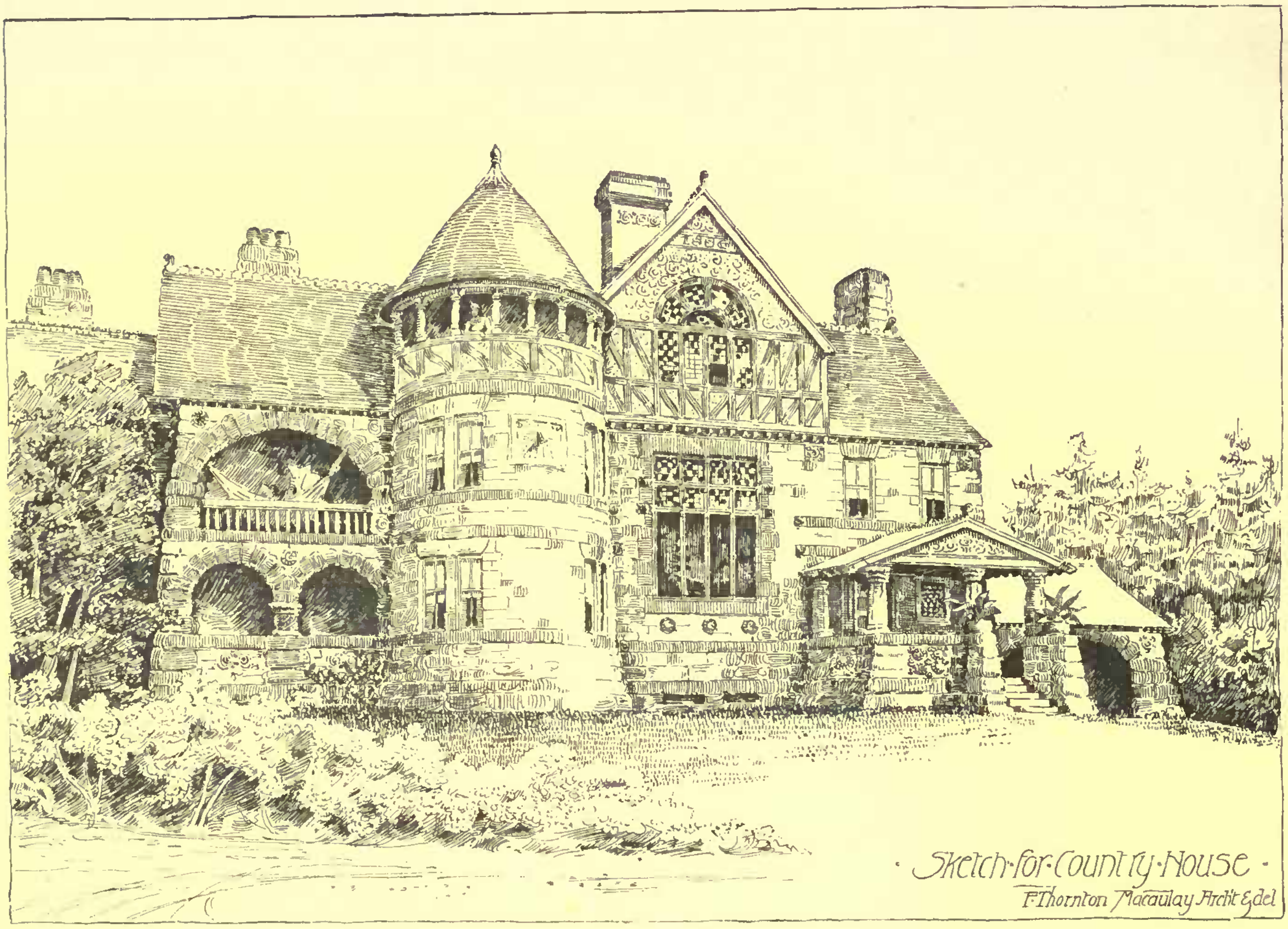
-Elevation of East Side-



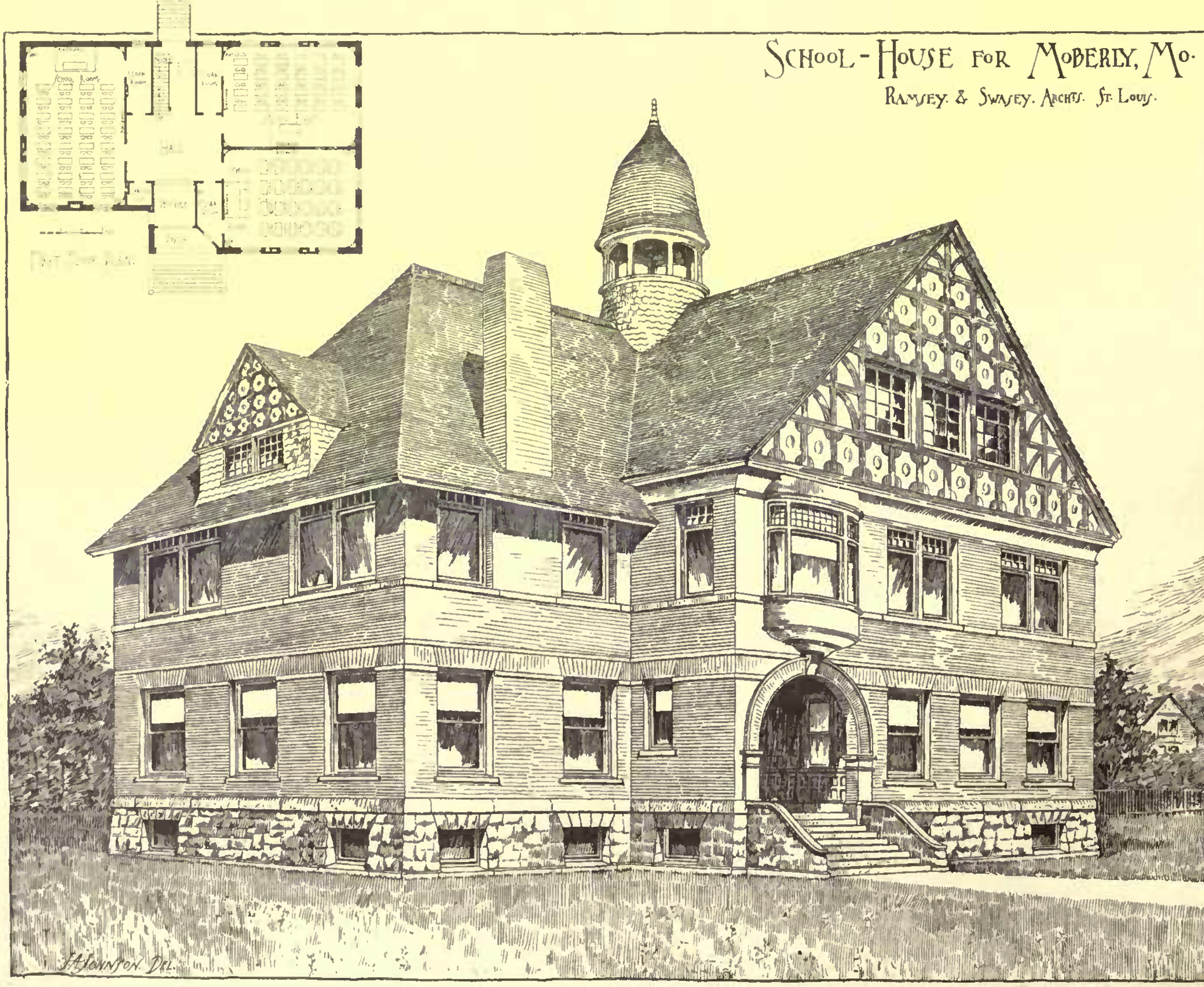
-Elevation of Main Staircase-

-American Architect Competition-
for a $5000 House - to be built on
A Barren Hillside
Submitted by "Boulder."



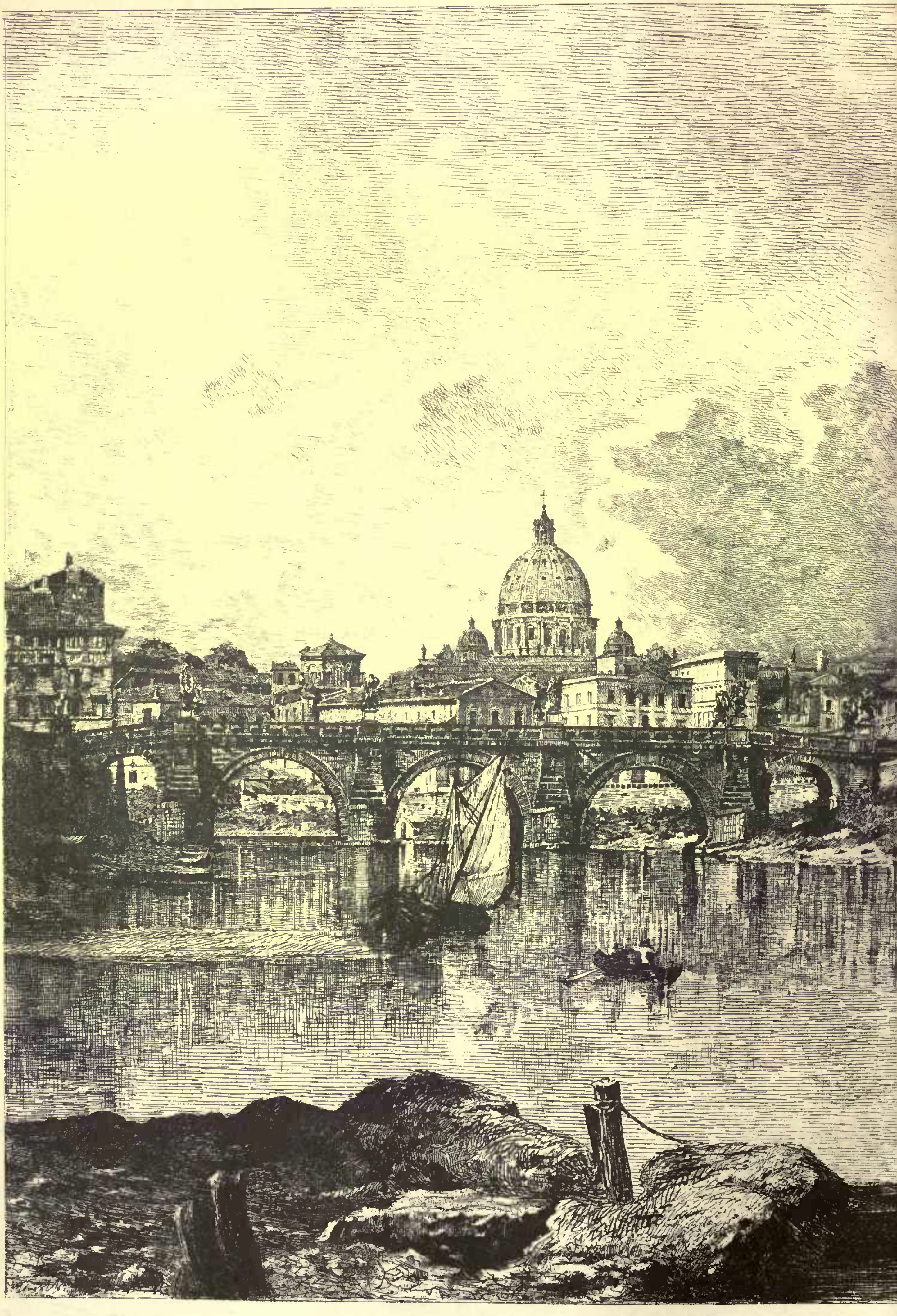


· Sketch · for · Country · House ·
F. Thornton Macaulay Archt & del

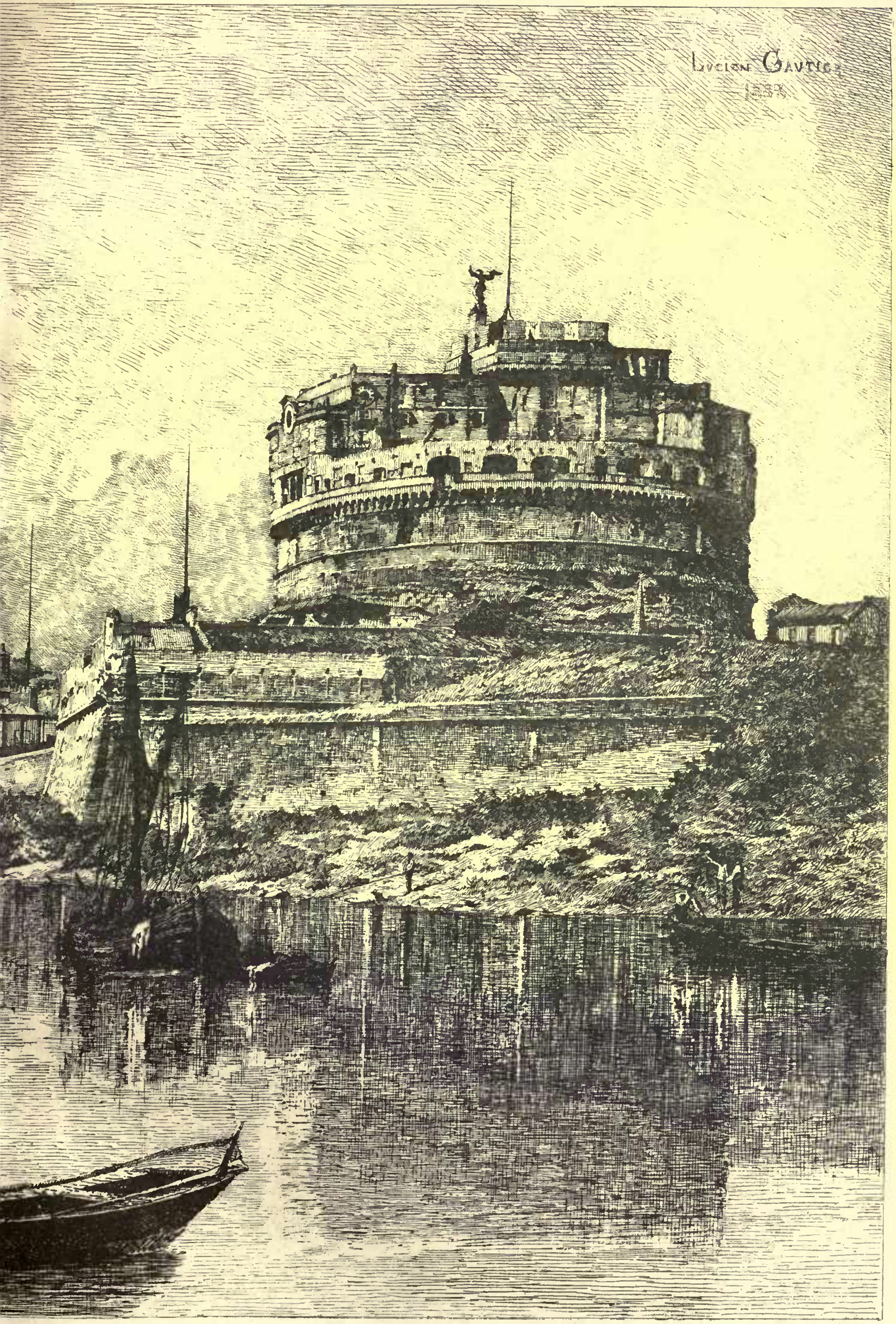


School-House for Moberly, Mo.
Ramsey & Swasey. Archts. St. Louis.

AMERICAN ARCHITECT AND



ROMA. CASTE



HELIOTYPE PRINTING CO. BOSTON.

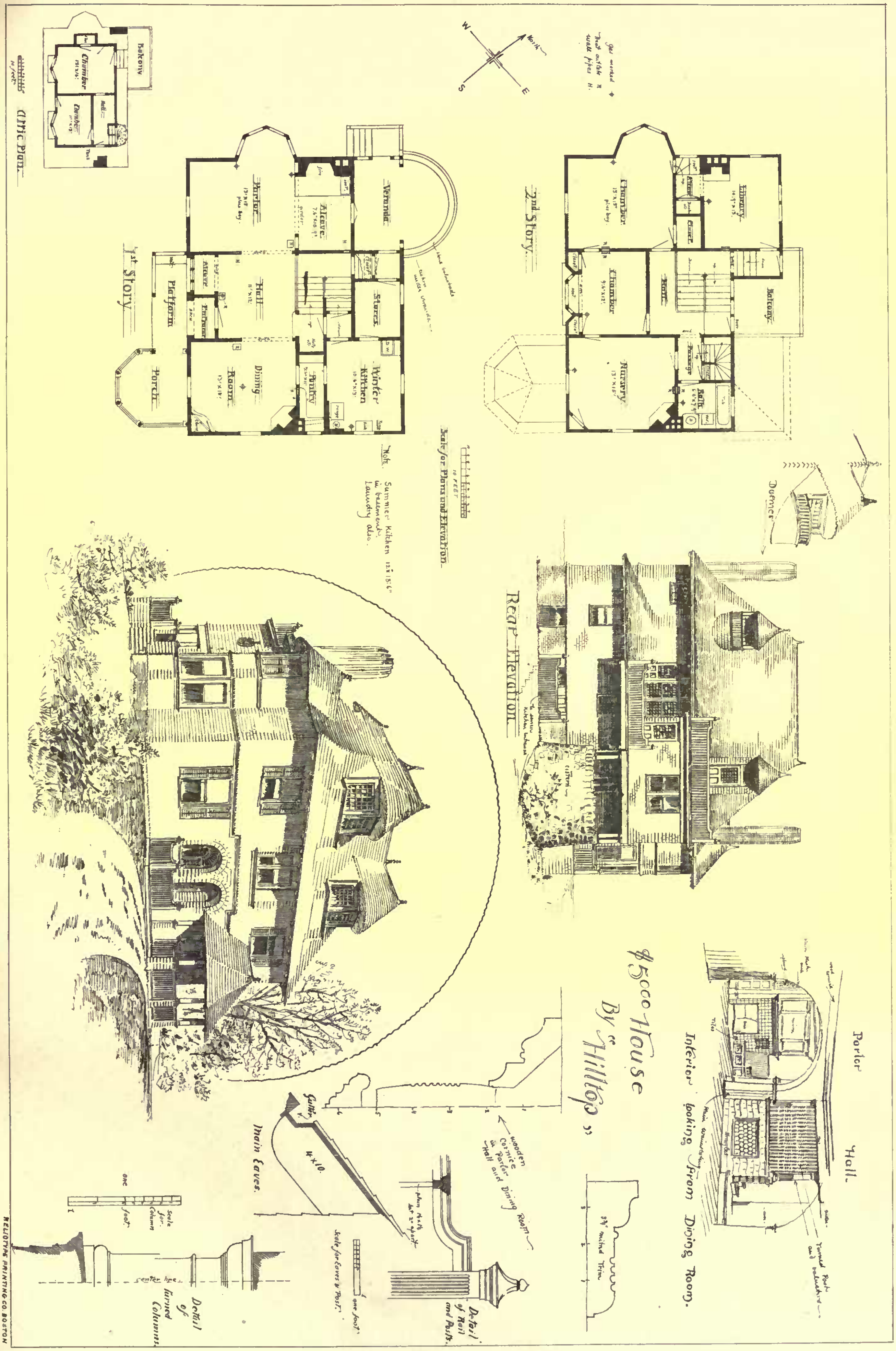
LO S. ANGELO.

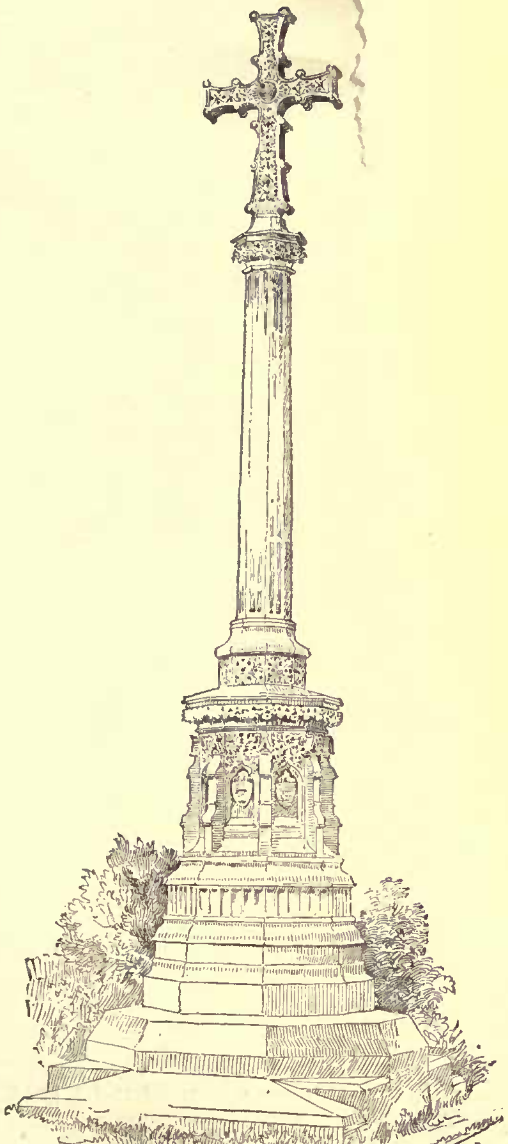


C. Howard Walker. Arch't.

Design for a Two-Story Church. Newton, Mass.

HELIOTYPE PRINTING CO. BOSTON


Attic Plan
Chamber
Balcony
1st Story
Parlor
Alcove
Veranda
Hall
Platform
Porch
Dining Room
Pantry
Winter Kitchen
Stores
2nd Story
Chamber
Library
Chamber
Nursery
Bath
Balcony
Scale for Plans and Elevation
Note. Summer Kitchen 12.5 x 18.6 in basement. Laundry also.
Rear Elevation
Dormer
$5000 House By "Hilltop"
Interior looking From Dining Room.
Porter Hall.
wooden Cornice in Parlor Hall and Dining Room
Main Eaves.
Scale for Eaves & Posts.
Detail of Rail and Posts.
Scale for Column
Detail of turned Columns.
HELIOTYPE PRINTING CO. BOSTON



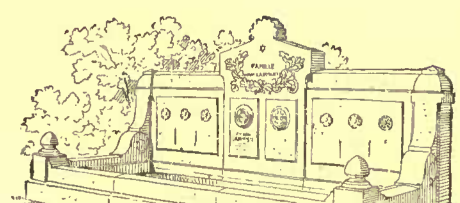
MONUMENT IN GLASNEVIN CEMETERY.
OF
THOMAS HENRY BURKE. UNDER SECRETARY FOR IRELAND.
(Assassinated in Phœnix Park in May 1882.)
THOMAS DREW. RHA. ARCHITECT.



Tomb at Passy
France
E. Lheureux Archt
Encyclopedie d'Architecture

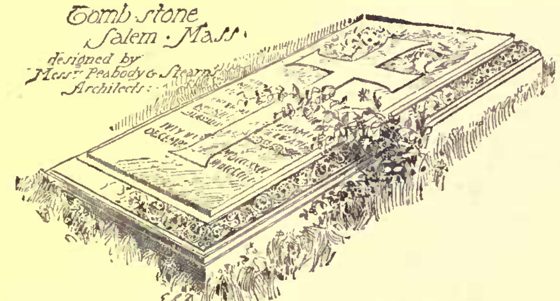


Tomb in Cemetery at Meudon France
M. Bossard Architect.



Family Tomb of Henri Labrouste.
Cemetery Fontainebleau. Paris.
Vol. 35 Revue Generale.

Tombstone
Salem · Mass.
designed by
Messrs. Peabody & Stearns
Architects.



FUNERARY MONUMENTS.

in two, the second, third, fourth and fifth floors; in one, the third and fourth floors; in twenty, the fourth and fifth floors, and in one, the fifth floor only.

In twenty-one, the large hall was in the middle of the front; in eighteen, at the end, upon a side street; in eight, it faced the front and side street; three were upon large courts in the rear; one upon the court-yard in the middle of the front; one extended the whole length of the front, and one was in the middle of the rear.

In thirty-one of these designs the safes were distributed in stacks throughout the building; in eleven they were concentrated in the basement; in ten, they were shown in the basement and first floor, and in one, on the first floor.

The Restaurant, in thirty-two designs, was placed in the basement; in eighteen, at the top of the building, and in three, upon the first floor.

In respect of style and external treatment sixteen were designed in some variety of Roman or Renaissance architecture, nine with a tolerably strict, and nine with a somewhat free use of Romanesque or round-arched mediæval motives, and not a single one in the pointed Gothic style, either modern or mediæval which, twenty years ago, or even ten years ago, was almost universal. There were seventeen designs, two or three of great merit, in which it was difficult to detect any special historical influence.

On opening the seals it appeared that in two cases two sets of drawings came from the same hands, in another three, and in another four. The result serves, however, rather to commend the course of the successful competitors, who made numerous duplicate designs for their own use, as a means of study, submitting to the Committee only the one they believed to be the best.

The provisions of the printed instructions proved to have been carefully complied with in every case, except that in one design the building had windows on the north side, where the plan furnished showed a party wall, and one design showed a building of eight or nine stories, disguised as mezzanines, instead of five or six. These were accordingly thrown out of consideration at the start, as were also some drawings of details which accompanied another of the designs.

A list was then made of fourteen which proved to have the best plans, and another of twenty-one, which had the most acceptable perspectives. Six designs were found upon both lists. To these six ten more were added from those of such marked excellence in either respect as to deserve further consideration. These sixteen drawings were then critically compared with reference to the provisions made for the general convenience of the public and of the Board of Trade, for lighting and natural ventilation, for office-room and rental, and for a suitable architectural character and expression, and the memoranda that accompanied them carefully read. They were then arranged in series under each of these heads, and those that stood highest on the greatest number of lists were then further considered on their general merits. Five of these were finally selected to send to the Building Committee as being on the whole distinctly superior to the rest, for one reason or another.

In estimating the area of the small offices, floor-space more than twenty-two feet from the windows was not counted, and in estimating their value, those upon outer walls were considered twice as good as those upon enclosed courts and areas.

This work, in which the professional adviser of the Association was aided both in the clerical labor it involved, and in the more difficult task of criticism and judgment by a number of his fri nds—the value of whose assistance he hereby gratefully acknowledges—occupied just a week. He then opened all the envelopes and reviewed his action in the light of the information they furnished, but without finding reason to change his mind. On Thursday, the 24th of June, the five selected designs were sent to the Building-Committee in Kansas City for their final judgment, with a written report, containing some comments upon the designs, but without any special recommendations. These reached the Committee on Monday morning, June 28th. This paper is printed below.

After diligent and almost continuous study, the Committee, on Wednesday, June 30th, came to a unanimous opinion. This they reported to the Exchange Building Association in the following terms:

"After a careful and detailed examinati n of these designs, your Committee rejected two as unsatisfactory, because in one instance the office rooms intended for renting contained too much floor-space to admit of a satisfactory rental from the building, and in the other instance, too large a floor-space was given to ante-rooms of little or no rental value. Of the remaining three, no one of which was entirely satisfactory, though each one contained very decided advantages of one character or another, the Committee finally rejected one because the Large Hall of the Board of Trade was without windows in the side walls, being lighted and ventilated through the ceiling, which your Committee was persuaded could not be satisfactory to the users of the hall. Of the two then left, your Committee finally selected the one marked '*Utilissimus*,' which was plainly the best of all for the lighting and ventilation of the offices, giving to the halls the best positions possible, and furnishing the largest number of offices for rent in the best groupings for advantageous use, and on the whole, promising probably the largest returns of income, and admitting of the correction of all supposed defects with the least interference with the main features of the plan."

Upon being assured by their professional adviser, who had meantime been summoned from New York, that the alterations suggested could easily be made, and that the author of the plan in question was entirely deserving of their confidence, the Committee formally voted to accept this design. The envelope containing the names of the five selected competitors being then opened, they found the selected design to be the work of Messrs. Burnham & Root, of Chicago, the other four, in the order of their preference by the Committee, coming from Messrs. Edbrooke & Burnham, of Chicago; Messrs. Weston & Tuckerman, of New York; Mr. John L. Faxon, of Boston, and Mr. W. W. Clay, of Chicago.

Although only these five designs were submitted to the Committee for consideration, all the perspectives were sent to them for their information, and to gratify a reasonable curiosity.

The Committee took no steps towards determining the relative or absolute cost of the buildings shown, believing that this was largely within their own control, being determined by the special materials or methods of construction they might adopt. These points they could most profitably consider in consultation with the author of the selected plan.

The course of this competition has thrown some light upon several questions, which, in discussions upon this subject, have been much debated. It has been questioned, for instance, whether it is desirable to have drawings made in perspective, the impression being a prevalent one that such drawings are likely to be misleading and deceptive, giving a much more favorable impression of a design than it deserves. However this may be with perspectives finished in water-colors, the contrary seems to be conspicuously the case with drawings in line, such as were asked for in this instance. The perspectives have in this case served mainly to bring into prominence defects of design that were not noticeable in the elevations, only those designs that presented a plane surface, almost unbroken by recesses and projections, seeming to be secure against a very serious disparagement when thus presented. In other cases, the composition of wall and window, plain and decorated surfaces, which in elevation looked all right, would often, when put into perspective, fall into shapeless disorder. Such drawings seems then, especially where the point of view is taken as near the building as in this case was necessary, rather to bring out the latent defects of a design than to invest it with fictitious merits.

It has been a matter of debate, also, whether the practice of concealing the identity of competitors under a fictitious name was of any value, the opinion obtaining that it was always easy to penetrate the disguise. The contrary has been the case, however, in this instance, the most confident convictions of half-a-dozen tolerably experienced architects having been ludicrously set at nought when the real authors of these designs became known. Only one or two correct guesses were made at all, and these took the form rather of surmise than of definite recognition.

This *incognito* has, moreover, proved to be of great practical convenience in judging the designs. Although, as was distinctly set forth in the paper of *Instructions*, the Committee intended to be guided in their final choice by personal and other business considerations, as well as by the relative merit of the designs submitted, they were very glad in examining the five sets of designs that came before them, as their professional adviser had been in selecting these five, to keep the two questions apart, and to be able to discuss the drawings solely upon their merits, leaving other matters to be considered when their time came. It was felt that to have entertained both questions at once would have been greatly to complicate and embarrass the discussion.

Some light has also been thrown upon the vexed question whether the final choice among the competitors should lie with a building-committee or with the experts whom they may bring into their counsels. It is certainly best that a committee should put the chief labors of examination and inspection into the hands of professional inspectors, if for no other reason than this, that in no other way can they so effectually inspire confidence, and prove themselves to be above partisanship and intrigue as by putting the exercise of favoritism out of their power. But it is not necessary to this end that they should have no voice in the selection, and questions may well arise, as in the case in hand, which demand for their solution an act of absolute and arbitrary choice which only the proprietors, or the committee representing them, are in a position to exercise. What relative importance to attach to rental, convenience and general architectural expression and character and what, on the whole, convenience will require, are not questions for a professional expert, but for his clients. In the present case, the professional adviser of the Association was able to select five designs with a certain confidence that each was, on its own ground, superior to the remaining forty-eight. But the differences between these five were differences rather of kind than of degree, raising questions, as is shown in the Committee's report to the Association, which only the owners could answer. It would have been impossible and improper, in this case at least, for any professional adviser to make their choice for them.

This competition has demonstrated, also, what there has been too much reason to doubt, that if proper regulations are made, it is possible to carry on such a contest, and bring it to a conclusion without the exercise of any personal influence whatever on the part either of the judges or of the contestants. The Committee and their adviser had, in this case, no knowledge or intimation of the authorship of any of the designs until after their judgment was formed. The competitors, also, with one or two insignificant exceptions, abstained

absolutely from any attempts to exert any outside pressure upon them, and in these cases were signally discomfited.

The designs sent in have not been seen by the successful competitor, nor by any persons except those mentioned above as having been specially invited to inspect them, and they will be forthwith returned to their owners, unless they otherwise direct.

Edward H. Allen,
William R. Ware.

REPORT.

New York, June 24, 1886.

Edward H. Allen, Esq., Chairman of the Building Committee of the Kansas City Exchange Building Association:

Dear Sir,—In fulfilment of the task intrusted to me by the Exchange Building Association, I have examined the fifty-three designs for the Exchange Building which have been sent in to me, and herewith enclose to you, in accordance with the provisions of the printed instructions, those which I find to be the best among them, five in number, with the following comments:

These five designs are, in my judgment, distinctly to be preferred, for one reason or another, to any of the remaining forty-eight. Any one of them, if carried out substantially as shown in the sketches, would give the Association an excellent and satisfactory building. This being so, it is for the Committee to decide which, on the whole, best meets their wishes as promoting their own convenience, or as furnishing a good business investment, or as possessing a suitable architectural character.

1. The design designated by a "*Corinthian Capital*" offers the largest number of offices to be let for business purposes—one hundred and five in all, besides four railroad offices. Of these one hundred and five, eighty are upon external walls, and look into the streets, and twenty-five are lighted from an interior court. This court is, however, of exceptional size. The safes are concentrated in the basement, where the restaurant also is placed.

The large hall for the Board of Trade is on the second story, and is lighted entirely from the ceiling, being under the large court. This leaves the main part of the building for offices, which accounts for their exceptionally large number.

The exterior of the building is dignified and monumental, without affectations of any kind, and in general expression and character is entirely suited to the purpose for which it is designed.

2. The design marked "*Utilissimus*" is second in number of offices, having, besides eight railroad offices, ninety-eight smaller offices. All but six of these are upon external walls, and thirty of them are connected with secondary rooms in the rear. If these are counted separately, the total number of small offices is one hundred and fourteen.

In this design, besides the safes accumulated in the basement, a considerable number are distributed through the building. The restaurant and most of the water-closets are in the fifth story.

The large and small halls occupy the fourth and fifth floors in the northern wing of the building, and the offices connected with them the southern wing of the fourth floor.

Light and air are introduced into the interior of the building by a large court, open to the street upon the south side. At the back of this court is an excellently-designed tower, giving the building an effective and striking individuality. The rest of the design, however, seems to leave something to be desired in point of architectural character and expression.

3. The design marked with a "*T-Square and Triangle*" is the third in respect of the number of offices and the first in the amount of floor-space given to them. Besides four large railroad offices, there are eighty-nine small offices, of which sixty are on external walls and twenty-seven on an area. Thirty-nine of these upon the outside walls are connected with twenty-three interior rooms. If these are counted as separate offices, the whole number amounts to one hundred and ten.

The restaurant is in the basement, and the safes are distributed in stacks through the building.

The large hall occupies the fourth and fifth stories at the east end, the offices attached to it, with the small hall, filling al lthe rest of the fourth story.

The exterior is treated in the Romanesque, or round-arched mediæval, style now coming into vogue, and is, perhaps, more agreeable in itself and more suitable for a building of this kind than any of those designed in this manner. It is quite free from extravagance and eccentricity.

4. The design marked "*Anti-Cyclone*" shows five railroad offices, all double, thirty-nine exterior offices, of which twenty are double, and seventeen on a court, of which twelve are double, making fifty in all. If the extra rooms are counted separately, the whole number amounts to eighty-eight.

A few safes are shown, distributed through the building. The rest are in the basement.

The large hall occupies the second, third and fourth stories at the west end, the offices attached to it and the small hall being in the second story.

The external aspect of this design, though not following the prescriptions of any special historical style, presents a simple and dignified architectural composition, eminently adapted to the important place this structure is meant to take among the public buildings of the city.

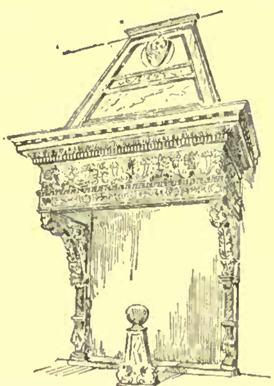
This is one of the few designs submitted which appears as well in perspective as in elevation. The tower with which it is adorned is unusually well composed, simple and elegant. It is to be noticed, also, that the two external courts on the rear, though not so wide as they well might be, not only give light and air to the rear offices and water-closets, but serve to detach the building from the rest of the block, to the great advantage of its appearance — making it virtually an isolated structure.

5. The scheme marked with "*A Pair of Compasses and a Carpenter's Square*" gives five railroad offices, and sixty-one others, all single, of which forty-seven are exterior, nine on a small area, and five on an interior well.

The large hall is larger and higher than in most of the others, occupying the whole of the second, third and fourth floors in the eastern end of the building. The offices attached to it, and the small hall, occupy the rest of the second floor.

In many of the designs submitted, the large hall was planned in the middle of the front, either upon the second and third, or in the fourth or fifth stories. But none of the competitors who adopted this arrangement succeeded, in my judgment, in giving it a satisfactory architectural treatment. Yours respectfully, William R. Ware.

THE LIFE AND WORK OF SIR CHRISTOPHER WREN.[1] — I.



Fire Place in State Bed Room. Doge's Palace. Venice. After sketch by J Vacher. A A Sketch Book.

Sir Christopher Wren, only son of Dr. Christopher Wren, was born at East Knoyle, in Wiltshire, on October 20, 1632. It will be an encouragement to some of us to know that he achieved greatness in spite of ill-health, which, like Tom Hood, he "enjoyed" during youth. In consequence of his delicate health his early education was given at home by a private tutor. Subsequently he joined Westminster school under the head-mastership of Dr. Busby. As is well known he early showed a special genius for mathematics, and on that account he was placed before long under the care of Dr. William Holder, a learned man of considerable and diverse talents. The special bent of Wren's mind early took a practical form in the invention of numbers of machines and instruments for the purpose of astronomy, agriculture, and many other sciences. Indeed, there seems to have been no subject of any kind occupying the attention of scientific men of his time in which Wren was not listened to with attention, or in which he did not distinguish himself. He made a special study of gnomonics, or the science of dialling, at that time a most important subject of investigation, and developed the science in many directions. Among other things he made for Dr. Scarborough a wonderful set of models, showing the actions of the muscles of the human body, unfortunately destroyed in the great fire. His mind was most versatile and comprehensive, and his inventions and treatises embraced all conceivable subjects, from "Improved Methods of Whale Fishing" to "Sham Marble Pavements," including "Cheap Bed-Hangings," and, as a matter of course "Perpetual Motion." He also made some valuable suggestions for the establishment and conduct of a kind of meteorological office for collecting statistics of natural phenomena, with a view to the amelioration thereby of the condition of mankind. It is held by some that Wren invented the barometer, but this seems a little doubtful. He made many important developments of the idea, however. In the year 1646, at the age of fourteen, Wren was admitted at Wadham College, Oxford, as a gentleman commoner.

In 1650 (aged eighteen), he received his degree of B.A. at Wadham College; in 1653 that of M.A., and was elected in the same year to a Fellowship of All Souls. In 1657, as a mere boy, he became Professor of Astronomy at Gresham College, London, and in 1660 Savilian Professor at Oxford. He received his degree of Doctor of Civil law at Oxford in 1661. In 1680 he was elected president of the Royal Society. This society took its origin in some informal meetings of a few friends interested in similar subjects, amongst whom Wren took the place of a leading spirit. When the suggestion was made to organize a society of a definite nature and for a settled purpose, Wren took up the idea with great vigor and drafted the charter under which the society was established.

It is stated that in the "Parentalia" that among Wren's many other achievements he invented the art of engraving in mezzotint. He was also the originator of the system of injecting drugs into the blood, which has been of such immense importance to the doctor's art.

So far as I can discover, Wren's first architectural work was the building of a chapel to Pembroke Hall, Cambridge, for his uncle, Bishop Wren of Ely. The bishop had been imprisoned for eighteen years in the tower, for High Church practices, and on his liberation he erected this building as a thank-offering. The first stone was laid May 13, 1664, Wren being then thirty-one years of age. The building has been restored by Scott, who added twenty feet to its length.

Apparently in the same year (1663), Wren's name was put on the list of commissioners for the repair of St. Paul's Cathedral. Various schemes and arrangements were discussed in connection therewith, but nothing particular was done until the beginning of 1666 — the year of the great fire — when Wren drew up a report and sketched out his ideas for the restoration. His plan was to Romanise the nave, the Norman arches of which seemed to him to lend themselves easily to this treatment, and to build an immense domed rotunda at the crossing, cutting off the outside angles for this

[1] A paper read before the St. George's Art Society by Mr. Arthur Keen.

purpose. The plans and estimates for this work were ordered on August 27, 1666, but six days later the great fire brought the labors of this commission to a close by destroying the object of their consideration. It was in the preceding year (midsummer, 1665), that Wren made a journey abroad, the only time, I believe, that he left England. The country he visited was France, and he spent most of his time in Paris, where the great palace of the Louvre was recently commenced. He was much struck with Bernini's design, and indeed stated that he would have given his skin to possess it. The cautious old Italian, however, only gave him a rapid inspection of the drawings, and would not allow him to copy them. Wren visited most of the palaces and villas of any importance in France, and must have reaped many ideas from them, although the influence of the French work is not very apparent in his own designs. He never went to Italy, and I am inclined to think — although, I suppose, it is heresy to say so here — that it is as well, on the whole, that he did not. His work would probably have been far more delicate and refined in detail if he had done so; but I cannot help feeling that he would inevitably have lost much of the originality and freedom of treatment which is undoubtedly the great charm of his work, and which fit it so admirably for this northern climate, and particularly for this City of London, where he was destined to find the subjects of his chief and most successful efforts. The inferior and even commonplace character of the detail in much of Wren's work is certainly very lamentable and a great drawback to one's enjoyment of the general composition; but it is, to my mind, quite a question as to how far Wren is himself responsible for this. He was so overburdened with work during the few years in which the city churches were erected that it is hardly possible that he could have given as much personal attention to the buildings as they needed, and he was probably compelled to leave the carrying out of his work, to a large extent, to less capable hands and heads than his own. It has to be remembered that the system of rapid and workmanlike drawing now in vogue in all busy offices was in Wren's time quite unknown, and it was impossible for the master to express his ideas and intentions respecting the carrying out of his work in the complete and definite way adopted by modern architects and their assistants.

The pencil of a ready draughtsman will give more instruction in five minutes than the tongue of a ready speaker will in forty. In cases where Wren was able to give proper attention to the work the result is admirable. In the church of St. Stephen's, Walbrook — to the arrangement of which, I understand, Wren gave particular care, and the building of which spread over seven years — the detail is very good indeed, and the whole interior works out as a perfect gem of architecture. It seems to me that the people who perpetrate the greater number of our dissenting chapels would do well to build on the model of such churches as this, which presents all the conditions usually considered essential in such buildings, treated in a manner at once graceful and dignified.

Wren returned from France some months before the plague ended, and applied himself with other members of the Royal Society to a careful study of the disease and its remedies, with a view to exterminating the enemy. The great fire, however, accomplished this for them in a far more summary and complete manner than they ever dreamt of, and Wren's thoughts were turned at once in quite a new direction.

The king set him to work immediately on the cathedral, which was to be demolished and rebuilt. The first design produced, after much preliminary discussion and planning, was a church on a thoroughly classical plan, consisting of a little more than a great dome with a surrounding aisle and entrances. Wren was so pleased with this production that he made a large model of it for the benefit of the uninitiated. A controversy naturally started at once on the merits of this plan, and waxed very fierce. Many of the members of the chapter preferred to have a building on a more orthodox plan, after the fashion of their existing Gothic cathedrals. The opinion of these worthies finally outweighed that of their colleagues, and the architect set to work again on new lines, and produced a design more curious than beautiful, combining central spire and dome in one composition. The king discovered this design to be "very artificial, proper, and useful," and gave his royal assent to it, and ordered the building to be proceeded with forthwith. This royal assent is dated May 1, 1675. Fortunately, the king gave Wren the liberty "in the prosecution of his work to make some variations, rather ornamental than essential, as from time to time he should see proper," a permission which he interpreted in the most liberal manner possible, for the cathedral, when completed, was no more like this design than its predecessor.

The pulling down of the old work preparatory to rebuilding was a long and difficult job. The mighty tower of the old cathedral, two hundred feet high, and with piers fourteen feet thick, seemed such a formidable object to demolish that Wren resorted to the expedient of blowing away one of the piers with gunpowder, a process that was at once simple and effectual. To those who meditate operations of this sort it will be interesting to know that only eighteen pounds of gunpowder were necessary for the carrying out of such an undertaking. Another explosion indulged in in Wren's absence having been attended with disasterous consequences, the remainder of the building was gently battered down with an enormous battering-ram "after a good Roman manner." In exploring the soil for foundations Wren found that the old church had stood on a layer of hard and close pot-earth about six feet thick. Under this was loose, dry sand which poured out like a fluid when excavated into, and below this again, at about low-water mark, water and sand mixed with shells, and under this was hard, firm beach, with the solid London clay below it. It appeared that the site had once been part of a wide estuary, along which, when it was dry, the wind had driven the sand and made the hill on which the cathedral stands, the pot-earth being simply the finest of the sand which had naturally found its way to the top. At the north-east angle of the choir the pot-earth had all been taken out and used by the potters of old time, and so here Wren had to run down a ten-foot pier to the hard beach forty feet down, and from this he turned an arch which carries this corner of the building.

Very little information is given in the "Parentalia" respecting the erection of the cathedral, but fortunately we have the building before us just as Wren left it to examine for ourselves. It has its faults, as every one knows — very glaring ones, according to some authorities — but I suppose there never was a building yet that some one or other could not find fault with on one account or another, and it seems to me on the whole, that St. Paul's is a building that may hold its own against any church of its own date, and one that the city has every reason to rejoice in and be proud of.

The chief fault found with the exterior is, of course, with the carrying up of the aisle walls far above the roof to hide the buttresses which support the nave vault. This was, however, the result of a choice of evils, and it has been managed so skilfully that a critic must be very hard-hearted who lays much stress upon it. As for the question of the double dome — the exterior being so much higher than the interior — I fail to see that this is any worse than the use of a tall spire as the roof for a low tower. No power on earth could devise a dome — unless an isolated one — that should look well both inside and out without resorting to some such expedient.

The chief faults found with the interior are, I believe, in the breaking of the arches into the frieze of the main entablature, and in starting the arches of the vaulting from an attic order instead of directly off the cornice. With regard to the first of these questions I certainly think it is a misfortune, and an unnecessary one. The effect of the frieze broken up into short bits over the pilasters only is, to my mind, most uncomfortable and unsatisfactory. Wren defended this arrangement himself with more or less ingenuity, but I think he would have done better by making frieze and architrave run boldly along over everything.

With regard to the springing of arches from an attic order this again was a choice of two evils, and I think that the lesser one has been accepted. It would be impossible for a vault springing from the top of a bold and well-proportioned cornice of great projection, such as the one in question was obliged to be, ever to look well, however ingeniously treated; and the effect of the existing arrangement, if looked at apart from theoretical considerations, is so pleasing that I think little fault should be found with it. Classical features were never designed to accompany arch construction, and, if we consent to the amalgamation of the two forms, we must accept the accompanying drawbacks as quietly as possible. Other faults are, of course, found with the building; indeed, some people would not be satisfied even if an angel from heaven designed work for them, but they are of minor importance, and need not be considered here. I always feel myself that more color decoration is needed inside if only to give scale to the building, but this requirement will, no doubt, some day be discharged.

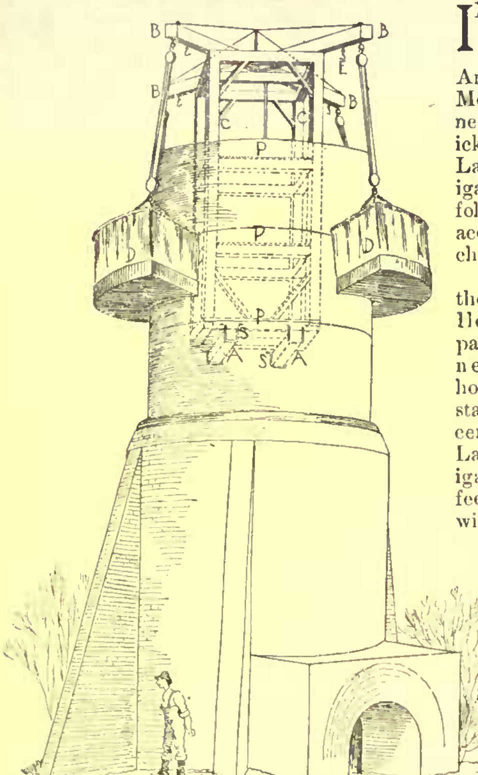
In excavating for the new cathedral and other buildings, many discoveries were made of remains of earlier times, and Wren worked out a careful, and I believe very accurate plan of the arrangement of London in the Roman times.

The first cathedral, built on the present site, dated from this period. It was demolished at the time of Diocletian's persecution of the Christians. In the reign of Constantine another church was built on the old foundations, and this one shared the same fate as its predecessor, being destroyed by the Pagan Saxons. It was restored again, still on the old foundations, when Ethelbert, King of Kent, embraced the Christian faith. This church, together with the whole city, was destroyed by fire in 1083. Mauritius, the then Bishop of London undertook the rebuilding, and produced, with the aid of an ancient tower in the neighborhood for a stone quarry, the church which, with some alterations and additions to the east and west, continued till the great fire of 1666. The first stone of Wren's building was laid in 1675, and the structure was completed in 1710. I suppose it is the only cathedral of any size ever built entirely under one architect; all honor to the people and king of that time that they persevered so well with such an enormous undertaking, when funds and resources were in such a desperate condition in consequence of the recent destruction of the entire city. The money for the work was mostly raised by a small tax on all coal brought into the city.

[To be continued.]

SIR PHILIP CUNLIFFE-OWEN RECEIVES THE ORDER OF THE BATH.— Queen Victoria has just conferred the star and collar of the Order of the Bath upon Sir Philip Cunliffe-Owen, Director-general of the South Kensington Museum. Sir Philip was in 1876 a British commissioner to the Centennial Exhibition at Philadelphia, and was the recipient of one of the four great silver memorial medals struck by the Centennial Commission.

A NOVEL CHIMNEY STAGING.



In a paper read at a recent Chicago meeting of the American Society of Mechanical Engineers, Mr. Frederick G. Coggin, of Lake Linden, Michigan, supplied the following interesting account of a novel chimney staging:

In the fall of 1885 the Calumet and Hecla Mining Company completed a new brick boiler-house for their stamping and concentrating works at Lake Linden, Michigan. It was 206 feet long and 70 feet wide, giving room for 14 fire-box boilers, whose shells are 90 inches in diameter, with a total length of 34 feet. The chimney designed for this boiler-house was to be of wrought-iron 13 feet 7 inches in diameter and 165 feet high, above the brick base upon which it stood, and the top of the latter was 20 feet above the ground, making a total height of 185 feet above the surface. The courses were 5 feet high with four sheets in each course, the ends and edges butted together, the joints being covered with straps riveted to the sheets on the outside. The first 10 courses were $\frac{3}{8}$ inch thick, the second $\frac{5}{16}$ inch, the third $\frac{1}{4}$ inch, the top three courses $\frac{3}{16}$ inch thick. The late arrival of the material for the chimney, with other circumstances, brought the commencement of its erection rather late in the season, so that it became a serious question as to whether it could be completed in time to allow the brick lining to be put in before the freezing weather set in. In fact, it became evident that with the ordinary method of staging it could not be done. Such a staging would have required 10 uprights of 8 x 8 inch timber, with the bracing necessary to hold them in position, and girting, and provision for a platform every 5 feet — *i. e.*, for every course — sufficiently strong and wide to allow the workmen to stand outside for holding rivets and bolting together, all requiring not less than 26,000 feet of lumber.

Such a staging would have to be put up in sections, during the operations for which the ironwork would have to be suspended, and the time put upon the staging and platforms would be nearly as much as that for putting the plates in position and riveting, and the expense full as much. But, regardless of the question of extra cost, the delay which such a staging would occasion made it imperative to devise some more rapid method for raising the chimney, and the result was the plan illustrated in the initial cut. This consisted of a frame about 9 feet square, with four 8 x 8 inch uprights 16 feet long, suitably braced and bolted together, with a platform at the bottom, one about 4 feet from the bottom, which carried the workmen while riveting, and one still higher for carrying the forge, etc., the platforms being indicated by the letter P. Upon the top of this frame were four arms, B, jointed at the centre, through which it was bolted to a cross girt, but so as to allow it to swing freely. To the ends of these arms were suspended the cages D by blocks and falls, as shown. These cages extended a little more than one-quarter round the chimney, and consisted of a segmental platform about 3 feet wide, with a railing of gas-pipe and covered with canvas to protect the workmen from the wind, and prevent the possibility of their falling. The whole thing required less than 1,000 feet of lumber. The frame having been bolted together within the chimney base, the process of erection might be begun. The cast-iron ring upon which the chimney was to rest having been put in place upon the top of the base, a loose platform was laid over the opening, and the first two courses were raised into place with a "gin-pole" and bolted together. Two snatch-blocks were then hooked onto the upper sheet near the two opposite corner-posts of the frame, at the bottom end of which were eye bolts, into which were hooked the hoisting ropes, which passed up through the blocks and down to the bottom through another pair of blocks on to the drum of a small steam-hoisting machine.

The temporary platform was then removed, and the frame was raised high enough so that the two sticks of timber A could be placed on the top of the base under the uprights. The cross-bars B were then put in place, and the cages D suspended, and the two courses were riveted together. The gin-pole was now laid aside, and the third course was put in place by the method to be used from that point to the top, the ease and facility of which are worth noting. In the arms B, just back of the eye bolts to which the cages were suspended, were other eye-bolts, E, into which was hung a snatch-block, over which was passed a rope leading from the hoisting machine, and hooked into the sheet upon the ground. As the sheet was raised the cage was swung out to allow it to pass up behind it, the sheet swinging naturally and easily into place, where it was secured with bolts. When the whole course was thus secured the snatch-blocks were hooked onto the top of the sheet as before, and the frame raised as before, so that the loose cross-beams A could be laid in the stirrups S, which had previously been bolted in place at the horizontal seam, and from this point up the frame, except when it was being raised, was resting upon the two cross-beams A hanging in the four stirrups, of which there were two sets, so that while the frame was hanging in one the other could be transferred to the seam above. There was, therefore, no delay, for as each course was riveted up and another bolted in place ready for riveting, but a few moments were required to hook on the snatch-blocks, raise the frame, transfer the cross-beams A to the next set of stirrups and drop the frame on to them. The sheet being riveted one-quarter round on the opposite side the cross-bars B were swung so that the cages covered the other two quarters, and the riveting was completed.

In this way, this travelling staging, carrying eleven men went to the top with no trouble whatever, the operations following each other in rapid succession, and within twenty-seven working days from the driving of the first rivet at the bottom the last rivet was driven at the top, including the hanging of three sets of guys and painting the chimney inside and out. A cast-iron capping having been put in place, a permanent iron ladder was hung from top to bottom. The cages were then lowered to the ground and the frame taken apart and dropped, two pieces of timber being laid across the top, from an eye-bolt in which were hung blocks and falls for the purpose of raising a platform which carried the masons and material for putting in an eight-inch lining, which was done in about twenty days. The blocks were then lowered and the cross-timbers dropped, and a completed chimney stood as a testimonial of the quickest time on record for such a job. The total weight of the chimney, including the base, ring, and cap is 100,105 pounds. The cost for the labor, including punching and rolling the sheets and straps, and all labor incidental to the erection, did not exceed two and one-tenth cents per pound.

BOOKS AND PAPERS.

THIS manual[1] appears as one in a series of hand-books adapted to the uses of intelligent students of the formative arts, and edited by Mr. Sparkes, the principal of the National Art Training School of South Kensington. This, perhaps, is the nearest English equivalent for the patronage of the French Ministry of Fine Arts, under which the original series was brought out by the well-known art-publisher, A. Quantin. Otherwise the title, with the memories of ponderously scientific German works that it awakens, might frighten the "curious spirits" for whom the book is primarily intended, next to classes in schools of art and other institutions of an advanced grade. M. Collignon's position as professor of classical archæology and art at the *Faculté des Lettres* (Sorbonne) of Paris is a guarantee of its scientific character. The subject-matter is disposed somewhat on the lines of Otfried Mueller's system. The origin of Greek art, architecture, sculpture, terra-cotta figurines, painted vases, coins and engraved gems, bronzes and jewelry are treated of in seven "books," which are subdivided so as to take proper account of local schools and technical categories, as well as of the chronological development. The author admits that he has conformed in this arrangement to the principle of expediency, like the director of a museum, who disposes its treasures to best advantage in halls of given number and position, different in size and form. His illustrations betray a similar compromise. Without neglecting the most famous antiques, he has endeavored to avoid the uniformity of selection that makes most modern hand-books of ancient art so uninteresting to the initiated. The cuts are from original drawings, and as large and plentiful as was possible. Thus the general impression the author aimed at is secured, even to those who only turn the leaves. There is a certain relief, now and then, in seeing specimens of inferior excellence alternating with the acknowledged chefs-d'œuvre. But the majority of the less noted antiques from which much of the illustration is drawn are far from inferior. Take, for example, the subject of Figure 139, a simply-attired girl placed between two flying love-gods, whose figure served as the foot of a bronze mirror. No large statue could be more finely plain. Where departure from the beaten track is so much the rule, it is no matter for surprise if some of the objects selected have been challenged as not being of quite certain authenticity. Among these is the relief of Herakles discharging an arrow, from the collection of M. Carapanos, the discoverer of

[1] "*Maxime Collignon*," a Manual of Greek Archæology, translated by John H. Wright. Cassell & Co.: London, Paris, Melbourne and New York. 1886.

Dodona (Fig. 36), which was recently signalled in the *American Journal of Archæology* as not a veritable early Greek sculpture. In the text, many alterations attest the author's willingness to take back opinions time and recent archæological discovery have not confirmed. In treating of Phœnician influences, M. Colignon once assumed that Dorian sculptors came particularly under the sway of the Punic models. In the translation we read: "Phœnicia did not possess a style sufficiently original and distinct to impress itself upon the earliest Greek sculptors."

The translator very probably originated many of the minor corrections noticeable throughout. Numerous additions and a few apt suppressions improve the lists of authorities that head the several chapters. The most commendable addition that has been made is a capital index, the typography of which clearly distinguishes the names of the ancient artists from their subjects, and these from the technical terms of ancient art. It will be seen that this English edition, prepared by a professor in an American college, has independent value. It is to be regretted that the translation is not always accurate. It falls far short of reproducing in English idioms the fibrous life of M. Collignon's style. To employ an archæological simile, it is not like the Roman copy in marble, which imitates an Hellenic bronze, with due allowance for the difference in the textures of the two materials, and an admixture of national flavor, so much as like the modern plaster-cast, opaque, neutral, and disfigured by threads. Some painful errors of the press for which the Atlantic Ocean is responsible, complete the likeness, by recalling the breaks and chips you find in your casts when they are unboxed. But, like these, they may be mended, for the manual is so splendidly suited to purposes of instruction in all the schools where the history of art is taught, or ought to be, that a second edition will, doubtless, soon be called for.

ALFRED EMERSON.

COMMUNICATIONS

[*We cannot pay attention to the demands of correspondents who forget to give their names and addresses as guaranty of good faith.*]

HYDRAULIC LIMES.

GREENVILLE, S. C., July 23, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — Some limes (those slightly hydraulic), dark and in powder, though not acceptable for plastering are equally good, I believe, for bricklaying.

I have never used any of the above, and have just been called on to pass upon some. The lime in question is perfectly inert after mixing with water, and a lapse of time sufficient to thoroughly slake good fat limes.

I have reserved my judgment, and if you can advise me in your issue to be of Saturday, the 31st of this month, it will be very acceptable and appreciated.

The lime in question is almost all powder, with lumps varying from three inches large diameter, to sizes about as large as a hazle-nut.

I would like to know how soon mortar made from same should bear the heavy pressure of one's finger without indentation, provided it is exposed in a thoroughly dry place and to a hot sun.

Yours respectfully, A SUBSCRIBER.

[IF you are right in calling the lime in question an hydraulic lime, do not be too impatient if it slakes slowly and without much ebullition, as it is the nature of hydraulic limes to behave so, "ordinary hydraulic" lime requiring an hour to slake, while "eminently hydraulic" lime is very uncertain, and may take several hours. It is to be remembered that hydraulic limes will set most satisfactorily if the work is kept rather moist; exposure to great heat will evaporate too quickly the water needed to complete the chemical change. If instead of being hydraulic, you have got hold of a "poor" lime it will be well not to use it if you can get a better brand.— EDS. AMERICAN ARCHITECT.]

THE EFFLORESCENCE ON BRICKWORK.

NEW YORK, July 20, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—A correspondent in your last issue inquires for some material that will prevent the efflorescence on brickwork, and having employed with perfect success an English preparation called "Duresco," I can recommend him to use it. If color is no objection, the brick-red shade gives the handsomest finish, as it renders common or hard brick non-porous, prevents salts appearing, and does not scale or come off. Where fine pressed-brick are employed, and it is not desirable to change the color, three coats of transparent or liquid Duresco will effect the object your correspondent is anxious to obtain.

Yours truly, HOWARD FLEMING.

CORRECTIONS.

NEW YORK, July 23, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,— Your issue of July 10, referring to the Kansas City Exchange competition, names Watson & Tuckerman of New York as third in the order of merit among the selected five. Please kindly correct the name in your next issue. The firm intended to be so designated is Weston & Tuckerman. We have the honor to be, dear sirs, Your obliged servants, WESTON & TUCKERMAN.

NEW YORK, July 24, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — The statement in the *Record and Guide* that any plans for the Freundshaft Club-House have been accepted, or even submitted by us, is entirely erronous. Yours respectfully,

DE LEMOS & CORDES.

THE $5,000-HOUSES.

WE have just received a note from Mr. Burdett, winner of one of the prizes in the $5,000-house competition, and author of the design marked "*Normandie*," which says: "I do not know whether or not it will be of interest to any one to know that the house is now being built, in a very thorough manner, at a cost of $5,500. This sum covers some increase in size over the design submitted, also fireplaces, hardwood floors, concreted cellar, plumbing and grading."

NOTES AND CLIPPINGS

THE ERUPTION OF ETNA. — The following extract is from a private letter from the engineer in charge of the Palermo-Corleone Railway, published in the London *Times:*

CATANIA, May 24.

You have probably heard of the eruption of Etna which is going on. I left Palermo Saturday and came here to see it. We left here about three o'clock (six of us, English) Saturday afternoon and drove to Nicolosi, which we reached about five o'clock, and got mules and went up to the scene. There were crowds of people going there, but we took a different road and went up much higher than the general crowd. We had a guide with us, and after about three hours' climbing we got to within a couple of miles of the crater itself. It is at the side of Etna, you know, not near the top, that this eruption has broken out, and we got on to a bit of high ground overlooking the whole scene. It was still daylight when we got up there, so that we saw the whole thing by daylight. We then settled ourselves down to dinner which we had brought with us from Catania, and of course it was soon dark, and here we were comfortably "feeding" before the most glorious and indescribable sight I ever saw in my life. It is perfectly impossible to describe it, as no one can have any conception as to what it is like until they see it, and also until they see it from where we did, which was on high ground overlooking nearly the whole of it. At the top is this enormous crater throwing out flames and throwing up stones some hundreds of yards, with a continued roar like any number of battles going on, and just below is another mouth from which the lava comes, travelling at an tremendous pace. It divides into several streams and follows the valleys. Now imagine from where we were that night, with our backs to Catania, what we saw. On our right, this enormous flame going hundreds of feet into the air, making the whole sky bright red, and all down past us from our right and extending down miles to the left, streams of red-hot lava moving downwards in a mass for miles and looking like an enormous sea of red-hot coke. The width across the lava where we were was, perhaps, three or four miles, and it started about two miles above us and flowed some four miles or so below us, so you must imagine a sea of angry, red-hot lava five or six miles long, and three or four wide, and about forty or fifty deep, but all of it bright red. You can judge whether it was a sight worth seeing. I would not have missed it for worlds. The lava is not liquid, as most people suppose, but consists of many millions of large and small blocks of rocky-looking stuff rolling onwards. We saw one huge rock of old lava standing in the middle of the stream of lava, which was divided by it and ran around it; the rock was about the size of (say) Quidenham Church, and this rock suddenly split into two parts; the smaller half crumbled up, and the other half was carried bodily down with the stream slowly and steadily. We watched it until we left, and it moved about three-quarters of a mile in about three-quarters of an hour. We waited there until nearly midnight, as we could not venture down until the moon got up, and then we reluctantly left this magnificent sight, which, as I tell you, no description can give you any idea of. As we went up we had all gone into a little house to see it, and walk round it, and thought it was unpleasantly close to the lava. Well, as we came down this house was in flames and caught by the stream. In many places we had to take different paths, so quickly had the lava spread as it came down; and from below it is awful (quite close to it), to see this mass thirty or forty feet high coming slowly towards us. I brought a piece of red-hot lava down with me which the guide got hold of for me, as I could not get it myself; it was so fearfully hot I could not go close enough. We put wire around it and I carried it down on the end of my stick. In fact we each brought a bit down, and also some ashes or cinders, which rained down on us whenever the wind was our way. We got back to Catania at about 4:15 A. M. We were up near the crater nearly four hours. We saw other people go up to see the lower end of the lava, stay there a few minutes, and go down again; but the way to do is to go right high up, arriving by daylight, and then stay there to see it by night, and watch the changes going on: it was glorious.

The Artist Population of Paris.—Paris contains 42,646 persons who call themselves artists, including painters, sculptors, designers, engravers, wood-cutters, painters on porcelain, actors, singers, musicians, and public performers of all sorts. A little over 20,000 of this number are women.—*N. Y. Evening Post.*

Growth of the Suburbs of Paris.—The movement of the Paris population from within the walls to the suburban communes is shown by the returns of the suburban census, which complete the results for the whole of the Department of the Seine. While with a total of 2,250,000 in Paris proper, the increase was only about 16,000 in five years, the numbers in the suburbs rose from 522,609 to 607,712, an augmentation of 85,103.—*American Register.*

Have the Martialists discovered the Virtue of Tree-planting.—"If we are to accept the theory just broached by a French astronomer, M. Maurice Lespiault, on the subject of the novel and unaccountable appearances discovered by Signor Schiaparelli on the surface of the planet Mars, they read a lesson to ourselves," says the *St. James' Gazette.* "The discoverer took them for canals; but M. Lespiault refuses to believe in canals a thousand miles long and fifty broad in Mars or any other planet. The mathematical regularity of the outlines forbids us regarding them as natural phenomena, however, and his conjecture is that they are vast strips of forest created to remedy the inconveniences to which the people of the planet found themselves exposed after having denuded the surface of their globe of the provision made by nature for their defense against the fury of the elements, as we are on the high road to doing ourselves."

The Dangers of Granolithic Pavement.—About 1 o'clock a. m. recently the attention of Detective Taylor, who was doing duty on Main street, was attracted by cries of "Help! Help! Help!" which seemed to proceed from a point at the corner of Main and Wall streets. Rushing to the spot he found that a young man and young lady, who had been standing there, engaged in conversation, for about two hours (he had previously noticed them several times), had recklessly, or thoughtlessly, or ignorantly chosen one of the fresh slabs of the new granolithic pavement which is being placed around the bank building, as a place for their confab. Now, as almost everybody knows, for almost everybody has stood and watched the process, this pavement is composed of a substance that hardens quickly, and the longer it remains the more solid it becomes. Well, these people were in a dreadful plight. They were fastened down tightly, they could n't move their feet. Mr. Taylor, comprehending the situation at once, ran to a cellar near by, procured a pick, and after a half-hour's hard work managed to release the couple, but their shoes were ruined. However, they were exceedingly grateful and promised Mr. Taylor their pictures as a reward of merit. The above is the story which Mr. Taylor relates.—*Bridgeport, Conn., Farmer.*

The Attractiveness of M. Eiffel's proposed Tower.—The iron tower which is to form the chief attraction of the Paris Exhibition of 1889 is already beginning to fill the Parisian mind with apprehension; and a *savant* explains in the *Moniteur* the curious phenomena which will be produced by this immense mass of iron rising to a height of 300 metres. He says that the enormous blocks of iron running north and south will become polarized, and that this polarization will soon invade the whole column. Then who knows whether the four lifts with their continual friction will not increase the magnetic influence a hundred fold? In this case all articles for a mile around will be attracted to the tower, and will adhere to it as a needle does to a magnet. If the troops quartered in the Ecole Militaire, hard by, be called out to drill, it will be all in vain for the commanding officer to shout "*En avant*" if they are paraded with the column behind them; they will irresistably be drawn to the rear, with the exception of the drummer, who does not carry a rifle. All the houses in Paris will suffer from a St. Vitus's dance and, gradually attracted toward the Champ de Mars, will finally find themselves stuck to the tower. As for locomotives entering Paris, it will be found impossible to stop them at the various termini; they will rush through Paris and dash themselves to pieces against the centre of attraction. These and other evils, we are told, will follow the erection of the great Eiffel tower; but then the *Moniteur* is opposed to the anniversary of the capture of the Bastile being observed, and may have exaggerated the consequences.—*St. James' Gazette.*

Buying Houses "on Easy Terms."—"If these easy-terms houses were just what they look to be," said the retired builder, "the deal would be perfectly square. But that is the costly rub. For instance, you want to buy a house for $3,000, and you pay $500 down and move in. Then you begin to pay off the balance at the rate of $20 a month. That's easy, is n't it? Just take your pencil and figure it up. Twenty dollars a month is $240 a year. Interest at 5 per cent is one hundred and twenty-five; taxes and water-rent, sixty more, and the total is four hundred and twenty." "Thirty-six dollars a month?" "Pretty nearly. But that is n't all. There's the repairs, my boy. You're lucky if you don't have to put on a new roof the second year; your pavement is sure to need repaving; the plumber will call on you about six times a year and, in short, you will soon find another hundred a year tacked on to your easy terms. Now what do you naturally do?" "I naturally kick," I replied with considerable energy. "'T wen't do you any good," said my friend. "You've signed an iron-clad contract. You must pay or go." "Exactly," responded the ex-builder, with a genial grin, "that's just what 50 per cent of the victims do. They do what they should have done first—figure it up and it scares them. They look forward to twelve years of this sort of thing and they see that they have the hot end of the poker; then they drop it." "Do you mean to say," I inquired, severely, "that none of the money is returned?" "Well," said my friend, meditatively, "there was a rumor once that a contractor did return about a third of the purchase money to a certain man, but as I never could find either the man or the contractor, I guess it was a ghost story."—*Philadelphia Call.*

Protecting the Ancient Buildings of Paris.—The Société des Amis des Monuments Parisiens, a body similar to the Society for Protecting Ancient Buildings, has taken up arms in defence of the historical and architectural relics which are menaced by the railroad, which is already called Le Métropolitan.—*Exchange.*

Concrete Floors.—These are sometimes formed on a centring of pieces of fir of proper scantlings resting on a trestle or on the lower flanges of the girders. Across these transverse pieces are laid, and boarded with boards of, say, 1 inch thick and close jointed. The concrete is laid in bays; each is finished in one operation, so as to form a slab. The ingredients may be as follows: 1 part cement to 4 parts of breeze or other porous substance, iron slag, hard bricks, well-burnt clay, which have to pass through a ¾-inch mesh. If fine stuff is required, clean smith's ashes may be used, as being better than sand, the fine stuff not exceeding one-third of the whole. Portland cement if fine ground, capable of passing through a sieve of 2,500 meshes per square inch should be used, and the following test is given: When made up wet and filled into a glass bottle, and struck level with the top, it must not in setting crack the bottle or rise out of it, or become loose by shrinking. When filled into moulds, and after being seven days in water, it must have an ultimate strength under tensile stress, slowly applied, of 250 pounds per square inch of section. The mixing is to be performed by turning the ingredients over twice dry, then shovelled to a third heap, at the same time adding from the rose of a hose water enough to make ingredients cling together. The broken material and breeze should be damped before mixing. The concrete, after being laid, is slightly rammed with wooden beaters, and the surface should be kept damp by water fourteen days after laying. The soffits should be well wetted, and a setting coat of fine stuff given. These are the instructions given in a specification for concrete floors, and may be usefully followed. Slabs of concrete 6 inches thick have been found to break from 1 cwt. to 2½ cwt. per foot super., the size of the slab being about 14 feet by 13 feet in the former case and 14 feet by 7 feet in the last. Experiments have not been sufficiently numerous or conducted with enough exactness to insure any reliable rule, the slabs crack suddenly, and there is little warning after the ultimate resistance has been reached.—*Building News.*

TRADE SURVEYS

All the industrial features are favorable. Although harping somewhat upon the same thing, it may be mentioned that the enormous demand for railway material and appliances of all kinds continues to be the most encouraging and significant factor in the entire situation. The fact has become more apparent that if railroad buyers carry out their programmes they will be obliged to buy foreign material quite liberally; in fact, brokers for foreign makers announce that they are about closing contracts for several large lots, for delivery in the Southwest, not on account of prices, but on account of the inability of American rail-makers to deliver rails at those points as soon as wanted. The probable volume of business of this kind is only guess-work. The production of the rail-mills this year will not be under 1,500,000 tons, and rail-sellers say they expect the bulk of the rail business will be done during the next two months. This is only one favorable feature. The other is the increase in inquiry during the past week for locomotives and rolling-stock of all kinds from palace-cars down to coal-cars. A great deal of stock is worn out and is being replaced. The car-builders throughout New York, Pennsylvania and the West have booked a large amount of business within six days, and are now negotiating for large contracts. There is also a good deal of activity at the ship-yards and the lake boat-yards. In fact there seems to be a general movement to increase the water-carrying capacity for heavy freight. A large amount of coastwise tonnage has been lost within a year, and owners have withheld the placing of contracts for its renewal, until more than doubly assured that their capacity would be profitably employed when finished. The iron trade is on the eve of a general moderate improvement. The coal trade has been strengthened by the action of the coal-trade managers of New York, in advancing prices. The demand will be heavy throughout the fall and early winter for both hard and soft coal. Consumers everywhere have been waiting to see how things will go, and, now that they see, they are going in to market and negotiating for supplies. The lumber trade may be similarly disposed of. The jobbing trade all along the Atlantic coast have been purchasing only to fill orders received. Several large dealers have placed contracts during the past week for lumber supplies to be delivered along during the fall. Prices are firm throughout the trade. The number of permits taken out in the larger cities throughout the country show no general falling off, but here and there fewer permits have been taken out. The general influences at work are of a favorable character. Architects are more busily engaged, and builders, especially in the Western States, are pushing forward contract work with all possible energy. In some near-by Eastern towns there is an appearance of dulness. Most of the work given out in the early spring is completed. Material of all kinds is firm. Bricks are still scarce at two or three points. Laths and shingles are coming forward liberally. The planing-mill interests all over the country are crowded with business, and the saw-mills are as full of work as they have been at any time for two months. A good many saw-mills are being erected in the Virginias and in two or three other Southern States. The crop report continues favorable. The possible supply of wheat shows a slight increase. Bearish influences creep out once in a while, but are short-lived. The cereal supply for export will be fully up to former seasons, and by some authorities is placed at as much as 50,000,000 bushels more. The aggregate of sales each week during the summer has shown an improvement over corresponding weeks last year, and this favorable condition of trade is likely to continue without any upward tendency in prices, and also without any undue effort to increase production in consequence. Manufacturing interests are guarding this point carefully. There is a steady increase in capacity in all branches of trade, but it is not a wild one. The mining industry throughout the country is in a highly satisfactory condition, a fact corroborated by the statements of leading manufacturers of mining machinery both East and West. Since July 1 several good-sized contracts for machinery have been given out, and several large machinery manufacturers write that their inquiries point to an unusual heavy pressure for machinery of all kinds from the finest to the heaviest.



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CONTENTS

PEOPLE who have not visited Washington are most familiar with the east front of the Capitol, because this is the view most often selected by photographers, and in certain ways exhibits a more complete design than that to be found on the western front. It has generally been understood that the western front was not quite finished, but what more was to be done to it seemed less clear, and the long flights of steps and somewhat abrupt earth terraces have remained for years as a rather unsatisfactory introduction to the great building above. About three years ago, however, a plan for finishing this front was arranged, and after the usual manœuvring adopted, and according to the habitual governmental practice an appropriation was secured for beginning the work on the lines indicated. As the changes were to be accomplished less by alterations or additions to the structure of the Capitol itself than by subsidiary improvements wrought in the grounds beyond the wall of the Capitol, it was not unreasonable that the design and its execution should be placed in the hands of a landscape architect, the one selected being Mr. F. L. Olmsted. The scheme adopted by this gentleman was, roughly speaking, to surround the Capitol on the north, west and south by a marble terrace wall in two levels, which should at once serve as retaining-walls, and so give some actual added security to the foundations of the Capitol, and likewise should, from certain points of view, have the semblance of a needed sub-basement on those sides of the building, and so enhance the architectural effect of the building as seen from Pennsylvania and Maryland Avenues; the architectural effect being heightened by the broad flights of steps, parapets, balustrades, and so on, introduced for that purpose only. But the plan provided for the actual enlargement of the building, by including below the terrace walks, and between the terrace wall and the basement rooms of the Capitol, some ninety compartments or rooms which could be used for one purpose or another, if for nothing more than for the storage of documents, coal and supplies, and for workshops of one kind or another, the removal of which thither from the main building would make rooms in it available for administrative purposes, to the great advantage of members of Congress and their underlings, who are now cramped for space. For nearly three years the work has gone on, and the terraces on the north are finished and work on other portions has begun; so that members of Congress and others can now form an idea of what the final effect is to be.

EACH year an appropriation for the fiscal year has been obtained for the work with more or less difficulty, until this year the difficulty has become a serious one and has resulted in the loss, if we understand the language of the *Congressional Record*, of the reappropriation of the unexpended balance of last year's appropriation. The trouble is this: it seems that members of the Committee on Appropriation and others understood that the new works would afford ample space for new committee-rooms of which there is much need, and their votes were given on this understanding. The plans showed many rooms; they knew the work was above the present level of the ground, and not being accustomed to the interpretation of drawings they may be excused for supposing that these rooms would have windows. When the northern terrace showed a solid marble wall they naturally asked where were the windows, and were told more or less authoritatively that windows exposed to northern light would be of no great use, but that when work was begun on the sides where sunlight could be of avail there windows would be found. But enough work has been done on these more favorable exposures to assure the anxious seekers for airy and well-lighted committee-rooms that the new works are intended to embrace none such, and that if committee-rooms there are to be they are to be furnished mainly with forced ventilation and artificial light, aided by such daylight as may come through dead-lights in the terrace walk above: although there are some few rooms which will receive indirect air and light by opening onto a small area, which is to be enclosed and treated as a winter-garden. Naturally the self-deceived or misled Congressmen wish to call a halt and stop the supplies till they can compel Mr. Olmsted to cut windows in his terrace walls, and give them the outer air and light they crave; and they scoff at all arguments based on the architectural fitness of things, and take the opportunity to cast many slurs on the architectural profession. Mr. Olmsted and his backers defend the work by showing that neither the plan nor the perspective drawing of the improvements, which for a long time before its adoption hung on the walls of the Capitol, showed any windows whatever. And they plead that to cut windows in the terrace wall would be to weaken or wholly nullify the chief object had in view in the preparation of the design, that is the providing for the Capitol an apparently supporting base of adequate proportion and massiveness. They lay stress, too, on the fact that the removal of the contents and occupants from the old rooms to the new will make possible such redistribution of space that committee-rooms can be found in the old building itself.

WERE it not for the present removal of the Congressional Library and its dependencies to the new building, and the probable though much more remote transference of the courts and law library to a similar building, which will put at the disposal of the Houses of Congress a very large space, which they can absorb for their own needs, we should side unhesitatingly with those who demand light and air. In the halls of Congress members have now to suffer the evils of imperfect light and ventilation, and it seems most unwise, when carrying out what is practically an enlargement of the building itself, to repeat the original error of excluding natural light and air, and renew evils needlessly, which in the older structure it has taken much ingenuity, time, and money to even partially cure. In the first place, even if the new terraces were actually and avowedly a basement for the Capitol, we believe that it would be practicable to introduce windows enough to satisfy the demand of the objectors without in any way weakening the effect it is desired to achieve. We believe that under the present conditions the result would be still more practicable, since the terrace must, to a considerable extent, count as a separate structure, except from some few points of view, and that it could be treated as such without doing violence to its character of retaining-wall to the building above. No scale is attached to the drawings before us, but the wall of the terrace seems to be at least forty feet in front of the walls of the Capitol, and to be from twenty to thirty feet high, and these dimensions seem to indicate that, except in orthographic projection on a drawing-board, the windows demanded might be safely introduced either in Mr. Olmsted's design or in some other equally well suited to the situation. It is not surprising that a landscape architect, whose instincts and predilections are above all things æsthetic, and in whose professional life the severely practical is never dissociated from the beautiful should feel that merely utilitarian needs must yield before considerations of artistic propriety. It seems to us as if he must begin to conceive of his results at the point at which the architect leaves off; that is, that he pictures to himself the result he wishes to achieve and compels the practical conditions to fit themselves to his intention; while the architect begins with the practical

requirements and does not lose sight of them in working out as æsthetic an embodiment as circumstance will admit. In the present case we do not imagine that such an artist as Mr. Olmsted has deceived himself as to the result he will obtain, and we believe that the terraces will form a satisfactory and dignified base to the Capitol. Still, as a structure enclosing above the level of the ground some ninety rooms, used more or less as work-rooms, we cannot but feel that, architecturally speaking, the terraces are a sham, and that for purposes of landscape architecture simple retaining-walls would have been sufficient. If, however, it can be conclusively shown that no openings can be made without doing injury to the Capitol, let us put up with one more sham, and beg our Congressmen, in the name of high art, to bear as patiently these new inconveniences as the ones they already endure.

IT would seem that by this time Americans would have become so accustomed to having American engineers accomplish seeming impossibilities that less opposition would be made by the uninstructed public whenever there was question of carrying out operations which, if successful, must unquestionably be of great benefit to every one. But property-holders are apt to look at matters from purely selfish standpoints, and where the failure of the operations would entail on them individual loss, it is not unreasonable that they should decline, as the Broadway property-holders have, to take an unequal risk for the benefit of the general public. The Arcade Railway, under the authorization of the law passed last May, seemed likely to be built at last, and the Company is said to have been successfully getting together its three million dollars of paid-up capital and its two million dollar indemnity-bond, which the charter of the road compelled it to provide before actual work had been begun. Meanwhile, the property-holders on Broad way, representing, it is said, over sixteen and a half million dollars' worth of real estate, held in fee simple, have organized themselves in opposition, and have obtained from Judge Barrett an injunction against the Arcade Railway Company, which they propose to serve on the Company in case actual operations should ever be begun. The grounds on which the injunction is granted include, of course, pleas that the law passed in May last is unconstitutional, that the Company's charter has expired, is defective, or does not cover the work which is in contemplation, and various other legal objections which do not concern us. The plea that the tunnel would interfere with existing vaults and cellars built out under the street can probably be met by showing that these structures have no legal right to penetrate beyond the curb-line. The possibility of excavating without imperilling the safety of existing buildings is a serious question, but the experience of the London underground railways, and the testimony of competent engineers, gives assurance of the entire practicability of the operation, and the question turns simply on whether the Company will prove to have sufficient financial strength to carry on the building of the tunnel, and the underpinning of such structures as may need it; but this is a mere matter of finance, and we believe the Company would be able to surmount this difficulty. The charge that the work would be a serious interference to traffic, sounds as if the objectors expected that the whole length of Broadway would be opened, from end to end at the same time, whereas the entire work would probably be conducted from two or three headings, and the excavated material taken down the side streets to barges, or up the other avenues out of the city. One of the most startling charges is that the entire amount of the indemnity-bond, two million dollars, would not be enough to indemnify the city itself for the damage done to its sewers along a single mile of Broadway. We hope that it will not be possible to prevent the execution of what we consider to be the most important public work which can be carried out in New York City. We call it so, because we feel that through it the traffic of Broadway will be revolutionized, and so bring about the reconstruction of a large portion of the older buildings which now line the street on either side much more speedily than would be the case in the natural order of things. This change, and the consequent increase of building operations, would begin almost immediately, as the undermining would probably affect the older and less well built, even if lighter, buildings quite as much as the more modern ones, and the owners, finding that new substructures were being provided for them, would see the advantage of joining hands with the Company, and making the new substructure substantial enough to serve as the foundations of wholly new buildings to be built forthwith.

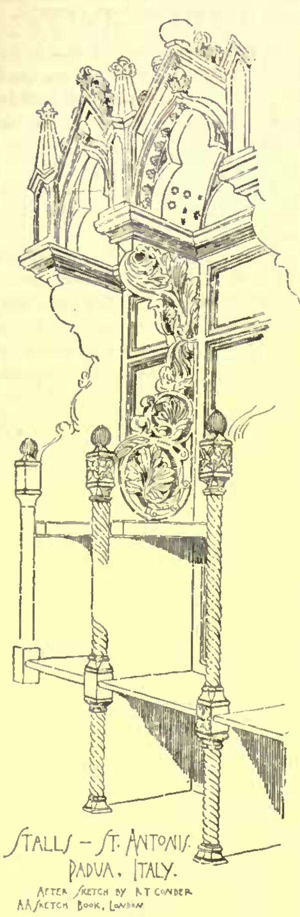
MANY a sympathetic ache has the observer experienced on beholding some of our remarkable public statues, and has devoutly wished that General Jackson, in Washington, could slacken his rein enough to let his rampant rocking-horse come down on his fore feet for just a moment, or that the General himself could unbend enough to give his cocked hat a final flourish and put it on his head; that Edward Everett in the Boston Public Garden could for one moment cease to be a dancing dervish, and put that uplifted hand into his pocket, or that any of the myriad figures just starting into action would for once follow the example of Don Pedro in the opera and complete what they have for so many years been trying to do. One weary master-piece has set an example which others would do well to follow, and having tired itself, the beholder and its support has tumbled to the ground and broken its neck. Last week the bronze statue of Dr. Horace Wells fell from its pedestal in Bushnell Park, at Hartford, through the decaying of the wooden pedestal which had supported it ever since its erection. We do not know the statue, so we do not know whether to repine that misfortune has fallen on a work of art, or rejoice because a special dispensation of Providence has overtaken a work of not-art. The fact that the statue was erected in memory of one of the claimants of the honor of having discovered the virtues of sulphuric ether as an anæsthetic recalls Dr. Holmes's advice when the matter of erecting in Boston a monument to Dr. Morton, the other claimant of the discovery, was under discussion. Referring to the uncertainty whether Dr. Morton or Dr. Wells had the better claim, he suggested that the monument should be a stone pedestal, bearing on one side the name or figure of Dr. Morton and on the opposite side that of Dr. Wells, while on the remaining sides of the die should appear the simple inscription "To ether."

THE National Academy has the reputation of doing many extraordinary and high-handed things, but, if reports are true, it has excelled itself in the treatment of a French artist of some repute, M. Bel, whose painting at last winter's exhibition was most discourteously skied. M. Bel gave himself the trouble to inquire why he had been so treated, and received an official letter which stated that, as he had evidently only sent his picture to the exhibition to escape the payment of the customs dues, he could not expect to be treated with the consideration shown to Americans, for whose protection the high-art tariff is maintained. How any body of men, if this tale be true, could have made such a reply, or how they had the audacity to act so in the face of the reports that reach us each year of the hanging of American pictures in the annual *salon*, passes comprehension. The affair is as inexplicable as is the action of Congress in declining to rescind the tariff, in spite of petitions signed by almost every artist resident abroad, and the protest of almost every reputable artist in this country — unless the solution is that the National Academy itself has the ear of Congress and is the unknown power whose arguments are more convincing than the entreaties of American artists at home and abroad. It is impossible that Congressmen should not understand how important to the progress of art in America and the advancement of our artists is the continuance of the present generous behavior of foreign governments to our art-students abroad, particularly in the case of the Ecole des Beaux-Arts at Paris. The situation is already strained, and it would not be surprising if this *contretemps* should prove the last straw.

LA REVUE INDUSTRIELLE gives a recipe for a solder to be used at a low temperature which some of our readers may find useful. In a solution of sulphate of copper in water a plate of zinc is hung, which precipitates the copper in the form of a fine black powder. The powder is collected, washed, dried, and rubbed with concentrated sulphuric acid in a porcelain or iron mortar. Seventy parts of mercury are then added, without stopping the stirring of the mixture, and the rubbing is continued until the mercury is all absorbed by the copper. The amalgam is then thoroughly washed with warm water, to remove the acid, and allowed to cool. At the end of ten or twelve hours it is hard enough to scratch tin. When wanted for use, a piece of the amalgam is heated until it softens to the consistency of wax. It is then only necessary to spread it over the surfaces to be joined, and allow it to cool. It adheres with great tenacity.

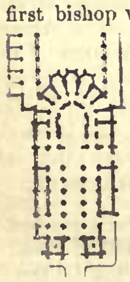
PORTUGUESE ARCHITECTURE.—I.

LISBON.



FOR some reason, Portugal seems to be but little visited by artists and even less yet by architects. It is difficult to say just why this is; for the country is quite easy of access, either by sea, if one does not object to a two or three days' voyage from England, or by rail, when one is at the same time making the circuit of Spain; and Portugal really offers many attractions to one who is interested in art of any kind, as well as to the simple tourist who travels only for the sake of new sensations and pleasant experiences. And with a climate which is a perpetual springtime all the year round, a situation hardly second to that of any city in the world, beautiful drives in every direction, good hotels and abundant opportunity for enjoyment, it is not surprising that those who do visit Lisbon are charmed with it and wonder why so few Americans ever wander in that direction. But Lisbon must be seen to be appreciated. As with a great many cities, a mere description can give very little idea of its beauties; possibly for the reason that there are not so very many things to describe, as Lisbon is poor in monuments. One can enjoy to the full the beauties of the wide Tagus, not crowded with the ships of many nations, as the guide-book announces, but simply dotted here and there with sailing and steam craft in a manner which tells of plenty of anchorage-room and a commerce not too busy for quiet enjoyment; and there are streets alive with busy trade: the Rua Aurea, lined with tempting goldsmiths' shops; an imposing square down by the water's edge, the Praca do Comercio; and there are pretty promenades and parks along the tops of some of the many steep hills about which Lisbon is built; but the architectural attractions certainly do not appear with any prominence on first acquaintance. Since 1755, the year when the city was so completely destroyed by the terrible earthquake, there have been few great architects in Portugal, and fewer yet of great buildings. A century and a half ago Lisbon must have been exceedingly rich in its architecture, however, for the few examples which the earthquake spared are by themselves of sufficient value to make a visit to the city well worth the trouble.

Down in the heart of the city, where the earthquake shocks have been most disastrous in their action, is the cathedral: a large, forlorn-looking structure externally, with two square towers on the façade, considerably the worse for Nature's rough handling, and an interior more notable for tinsel and gaudy over-decoration than for its architecture. Indeed, the cathedral as it now exists is interesting principally for its plan. In considering this building it may be of value to know that it was undoubtedly begun under English influences, as the first bishop was from Salisbury. The cathedral was built in 1147, and suffered repeatedly from earthquakes, losing nearly all of its parts except the towers and portions of the apsis, and being renewed at so many different periods that its original Gothic character has been quite obliterated by weak late Renaissance work, though the same general disposition of plan has always been preserved. Of all the churches throughout Portugal this is the one whose plan most nearly approaches the perfected Gothic type such as was understood in France. Indeed, there is no other example of any importance which possesses a fully developed circular apsis with radiating chapels.


Cathedral. Lisbon.

Lisbon extends along the right bank of the Tagus for a distance of about seven miles. The most western portion of the city is known as the suburb of Belem, and possesses some work which is worthy of careful study as being not only the best in Lisbon but also the most characteristic architectural effort the country has ever put forth. In the fifteenth century a modest and very ancient oratory existed at Belem. When Vasco de Gama was about to depart for the voyage of discovery which rendered his name so famous, he came hither to invoke the aid of the Virgin, and the Infante Don Manoël, who was to accompany him on his perilous journey, made a vow that, should the enterprise meet with the success expected, he would construct, on the site of the chapel, a church which should exceed all others in magnificence. Two years later, in accomplishment of the vow, the present church of Belem was begun. A convent was built at the same time and occupied by Hieronymite monks of the order of St. Jerome.

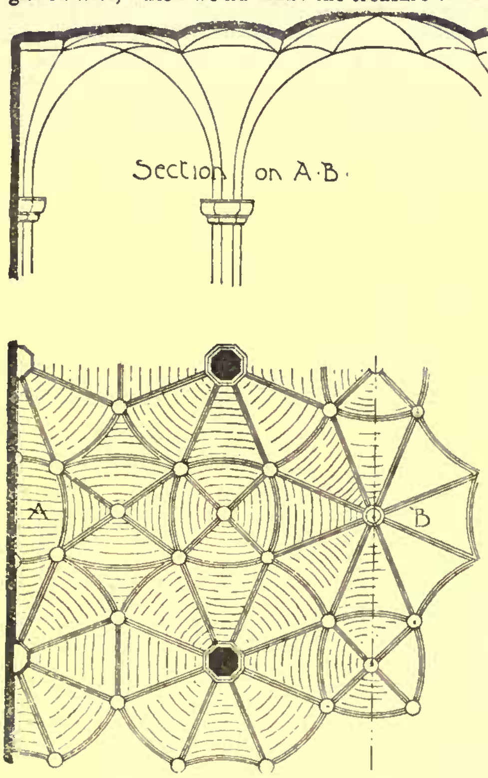
The design is wholly Portuguese in all its details, and there is no evidence, internal or external, to show that foreign influence had to do with it in any way. In this respect it is almost unique of its kind, as the greater portion of the Portuguese edifices, secular as well as religious, have been planned by foreigners, or so modified by direct foreign associations as to represent only imperfectly the true architectural tendencies of the nation. Never before or since have the Portuguese had as genuine an inspiration as is evinced here. It would be very interesting, if it were possible, to trace out the antecedents of this design, and see how it was derived from the contemporaneous architecture of other peoples; but documents are lacking altogether, and the eighteen earthquakes which have at different times visited Lisbon have quite destroyed all trace of any local edifices which could have prepared the way for a design as rich and abundant in ideas as this. The general scheme might be designated as thirteenth-century Gothic, though in no other country was the Gothic ever treated in such a florid, fantastic manner. The details of carving and ornamentation are strongly Renaissance; and in the way the finials and flowered cornices are arranged, and in the disposition of fine, fret-like ornament, contrasted with broad, plain wall-surfaces, as well as in the effective use of high lights and strong shadows — the almost plastic feeling of the design — there is evidence that the Moors left their influence in Portugal quite as strongly as in Spain. To say a design is Gothic in general scheme, Renaissance in detail, and Moorish in sentiment, might imply almost an impossibility, and yet that is exactly the impression the Belem church leaves on one's mind, though with this important modification: that Gothic, Renaissance and Moorish do not exist as such, but become as it were suggestive points of a design which is as thoroughly and consistently Portuguese as the Sainte Chapelle of Paris is French, or Giotto's Campanile Italian.

The church is built entirely of a beautiful, cream-colored sandstone, varying slightly in tone, with just enough reddish glow to give it a warm lustre; and under the vivid intensity of the southern sun the imaginative, finely-wrought design sparkles like the frost palaces of a window-pane, if one may compare the warm and the cold. The exterior is simple in the disposition of the masses, presenting a lateral façade towards the street, broken only by the slightly projected base of the unfinished western tower, and by the square and perfectly plain transept. There are no buttresses of any size, and the sky-line is formed by the serrated cresting of the cornice, the roof being so nearly flat that it does not appear with the façade, a feature common to nearly all Portuguese work. The richness is concentrated about the lateral portal shown by the sketch, a design which, while not lacking in faults, has a general effect according well with the character of the design, and possesses considerable dignity of composition, from a Portuguese standpoint, at least. Nearly all of the details of this portal are good. The statuettes, the arabesques, the heavily panelled doors, the delicate canopies, the curiously tortured shafts, the sturdy figure of the old navigator keeping watch in the centre, and the graceful statue of the Virgin rising on the topmost wave of foam-like carving, are individually so pleasing and full of spirit that one can easily pardon a great deal of the collective lack of repose.

The interior arrangement is indicated by the plan. By comparison with other Portuguese work, it would seem more than likely that the apsis was originally square in termination, with a large window behind the altar. The existing apsis is a late Renaissance alteration. The dimensions of the church are eighty-two metres from the front portal to the steps of the choir, thirty-four metres in width at the nave, and sixty-four metres across the transepts. The clear height of the nave is about thirty-five metres. The church is covered by a triple line of vaulting, of construction so daring that such a project on paper would hardly seem practicable. Indeed, as it was, the vault fell in after being first built, and history tells us that the plans of the architect inspired so little confidence that no workmen could be induced to undertake the task of rebuilding. The vault was finally completed by criminals condemned to death, who were offered a free pardon if they escaped alive. The work proved successful the second time, and held so well that, although the church was violently shaken by the great earthquake, not a stone was dislodged. It is doubtful if the French, good constructors as they were, ever built a vault which would stand so violent a test as that. The sketch diagram can give some idea of the approximate arrangement of the vault, which is not unlike the fan vaults of Henry the Seventh's chapel at Westminster, except that here the fans are not cotangent, and they make complete circuits about slender pillars, whereas in the English chapel the vault has all the benefit of the resistance of a firm, continuous wall. The supporting piers are twenty-five metres high to the spring of the vault, and about one metre and a half in diameter.

The cloisters immediately adjoin the church to the north, and are in the same style, but with details more pronouncedly Renaissance in character, which would seem to indicate that they were built later than 1500, the year the church was begun. The second-story cloisters are incomplete, lacking the slender, twisted columns, and curious, cusped archings which make the lower portion so interesting; but restorations are now in progress, and as it is simply a question of repeating details which already exist, the cloisters will eventually possess all the picturesque interest of the original design. The monastic orders were suppressed in Portugal about 1830, and the buildings of the Belem monastery were converted into a *casa pia*, or orphan

asylum, which is a model of arrangement in its way, the sanitary appliances being especially complete, a condition which somehow one seldom expects to find realized in southern countries. In the vestibule, and in the old refectory, the walls are still covered with fine old glazed tiles, which would make the treasure of some museum. They are for the most part in blue, not unlike Delft ware, and are painted with Biblical scenes. A few of the monastery buildings are not without interest. One long façade adjoining the church towards the west has been lately restored in fairly good manner, though the construction was carried on so badly that a short time since one of the new towers tumbled down to its base. The single-arched portal, shown on the sheet of sketches, is a portion of this wing of the monastery.

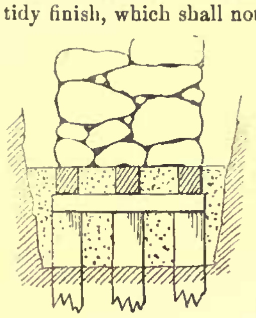


Vaulting of the Belem Church, Lisbon.

But this is not all the architectural richness which the Belem suburb possesses. About three-quarters of a mile to the west of the church, on a bit of sandy beach stretching out into the Tagus, is an interesting piece of Gothic military architecture, the purest specimen of the style in the country, and so quiet and simple by comparison with the convent church that one is strongly inclined to ascribe to it a foreign origin. It is built right out over the water, and forms nominally a part of the military defenses of Lisbon, though it is not actually used as such, and, despite its fierce embattlements and deep embrasures, it would be but a slight protection against modern artillery. Towards the land it presents a square tower, thirty metres high, flanked on the right by a heavy portcullis and gateway, and on the left by low fortifications. The elevation shown on the sheet of sketches is a measured drawing of this front. Towards the rear a wide *terrasse* extends far out over the water, guarded at the angles by heavy turrets, and with a large, open well in the centre, giving light to a spacious crypt extended under the whole platform. The tower and the adjacent parapets are crowned with high battlements, bearing shields carved with the cross of Malta. The tower is built of the same beautiful stone as was used for the monastery church, but the action of the salt air has given it more tone and deeper streaks of red, so that it forms a striking picture, whether seen from far down the river or from across the long stretch of deserted sands. The Portuguese assert it to be one of the best pieces of architecture in the country. The only drawback to such an assertion is that it is less distinctively national in character than the church, though to a stranger that might not be altogether an objection.

It is of interest to note how little influence Spain seems to have exerted upon the architectural efforts of Portugal, for, although both countries were at one time under the same government, and are separated by no great natural barriers, they are now quite distinct from each other in nearly every respect; and, excepting for the Moorish element which, after all, is very slight in its influence, Portugal seems invariably to have passed by its neighbor and drawn its ideas from countries with which it might be supposed to have far less affinity. The difference between Spain and Portugal in regard to private habitations is quite striking. In the larger country whitewash and stucco reign supreme. The ordinary Spaniard, especially if he be an Andalusian, seems to have a real mania for making everything look fresh and clean, even at the expense of covering up good architecture. The Portuguese are quite as clean in their intentions, but they secure a fresh, tidy appearance for their houses in a very different way, namely, by covering them with tiles — a custom which has been worked out nowhere else in the world. The Moors, and all the related races, used tiles very extensively for floors, dadoes, fireplaces, etc., but in Lisbon the exterior walls of nearly all the houses are covered with glazed tiles. Often there will be almost no architecture whatever; a tile base-course, tile window and door-jambs, tile belt-courses, and a tall tile frieze under the overhanging roof; but the plan usually followed is to build the walls of common, irregular, rubble stone-work, carrying up the angles of the building and all jambs in cut sandstone, and occasionally extending one or two plain belts across the front. The stone bands, both vertical and horizontal, are quite narrow, and are projected about an inch from the face of the rubble masonry. When the building is entirely completed, and has had ample time to settle, all of the rubble work is covered by tiling set in stucco or cement, so as to be flush with the cut-stone jambs and angles. This work will stand practically forever, will look as well at the end of three centuries as when first put in place, and is so far superior to stucco in every way that there is no comparison. There seems to be nothing impracticable in the application of the tiles. The writer spent several days examining this work all over the city, and did not find a single tile which was loose, or about which the pointing had worn away. The tiles are all manufactured in Lisbon, and the ordinary kind with simple, printed pattern can be had for a cent each. Generally they are figured in some way. Plain white tiles are never used, but sometimes a single tone is employed, and there is one quite striking instance, a house out towards Belem, where tiles of an unbroken, dark sulphur color are used over an entire front with a very successful effect. Blue is, however, the color most employed — a blue pattern on a white ground, the tone being pretty closely imitated in water-colors by a strong wash of French-blue. Lemon-yellow figures are sometimes used with the blue, and occasionally there is introduced some brown-madder or Hooker's-green in varying shades, though blue is always the predominating color, and is the only one which is ever used alone for a figured tile. The patterns vary infinitely. Generally nothing but geometrical designs or leaf-forms are employed; but a few of the better houses still exist which are covered with tiles painted in a more ambitious manner, with scenes wherein architectural forms and human figures are introduced, the entire façade serving as a ground for one design, which is adjusted to the architectural framework. Such examples, however, are exceedingly rare. Unglazed tiles are never used.

It is not difficult to see from whence this custom came, at least, if we may judge by external analogies. The Moors undoubtedly left in Portugal, as they did in Spain, a knowledge of the manufactures of ceramics and a taste for tile work. The Portuguese, after their brief rule over the seas, were succeeded in maritime supremacy by the Dutch, and it was from this latter people that the idea was taken, though here, again, the Portuguese showed their individuality, for, while the colors and many of the patterns are quite the same as those which are found in old Dutch tiles, the Lisbon work is a style to itself, being more free in treatment and better adapted to general effects than any Delft ware ever was. But it must be admitted that the Portuguese have by no means perfected this mode of exterior finish, or decoration, whichever it may be termed. The idea is excellent, and, properly developed, nothing more brilliant and interesting could be imagined than a long street, to say nothing of a whole city, clothed in all the beautiful hues which are to-day so easily produced by the ceramic artists. It is surely the nearest approach to a perfect scheme of exterior color-decoration that has ever been devised. In Lisbon it seems to have been worked out only enough to give a clean, tidy finish, which shall not be disagreeable to the eye nor difficult of application, and comparatively little of what can be called real design is apparent, so that the effect is not always as good as might reasonably be expected.


Piling.

A practical detail of Lisbon architecture may not be out of place here. The city is so hedged in by the hills that of late years some of the shallower portions of the broad river have been filled-in and constructions erected thereon supported by piling. The disposition of the piles is not unlike that in vogue in Amsterdam. They are driven in rows of three or more across the thickness of the wall, connected by heavy cross-timbers, and the rows united by lines of stringers or tie-beams, one over each line of piles. The spaces between the piles, and for a depth of one or two feet below the tops thereof, is filled with concrete, which is carried up to the level of the longitudinal sleepers, forming a solid platform on which is begun the work of the foundations, generally in rubble stone. The adjoining figure will illustrate this construction.

C. H. Blackall.

The Slums of Berlin. — The slums of London and Paris are bad enough, but it appears that the slums of Berlin are, if possible, worse. *Das Echo* has just published some interesting details on the subject. There are about 40,000 houses in the Prussian capital. A small number are inhabited by one or two families, but the great majority are divided into several distinct lodgings. Two thousand five hundred contain from sixteen to twenty lodgings; 20,000 from twenty to thirty lodgings, and 10,000 over thirty lodgings each. Seventy-five thousand of these lodgings are composed of one room only, and inhabited by no fewer than 270,000 persons, which is an average of nearly four persons per room; 75,000 other lodgings are composed of two rooms, and occupied by 360,000 inhabitants; while the remaining 30,000 lodgings are formed of three rooms, inhabited by 140,000 people. These figures show the promiscuous way in which the masses of Berlin population are lodged. The houses in the poor quarters, often five or six stories high, are built so close to one another that they are nearly totally devoid of light and air. — *The Building News.*

AN EDITOR'S TRIP ABROAD.[1]—VII.

THE CLEANLINESS OF GENOA.



Mediaeval Ship.
From Old Manuscript.
A A Sketch Book. London British Museum.

In my younger days I used to think a good deal about Italy. My grandfather had several pictures of Italian scenery, which seemed to indicate that the female inhabitants of the country spent their time in reclining or dancing under arbors covered with grapevines, while the gentlemen, dressed in tight red pantaloons, made in one piece with their pointed slippers, played on guitars, and symmetrical volcanoes spouted smoke in the distance. Later, when I had German lessons to study, my previous conceptions were disturbed by reading in one of them about an Italian patriot who, when the representatives of other nations were boasting about the industries of their respective countries, could not think of any industry practised in his native land except organ-grinding; and, comparing this sort of labor with that required for keeping somewhere within sight of the head of one's class, I was led to form an unfavorable opinion of Italian energy. All this served to increase considerably my surprise at the efficiency which seemed to characterize everything in the way of official action in the small part of the real Italy that we saw. Instead of plunging at once, on crossing the frontier at Ventimiglia, into a sea of rags and beggary and filth, as we rather expected to do, we found the Italian cars and stations quite as clean as the French, and the railway and custom-house officers as prompt and civil, while the beggars, instead of following us about in swarms, were nowhere visible, and except one privileged old woman inside a church door in Genoa, I do not remember seeing a single mendicant between Ventimiglia and the Swiss frontier. As to the filth, which is, I am sure, generally supposed to be the weak point of Italy, I can only say that we found nothing of it, but were, on the contrary, filled with astonishment and admiration at the cleanliness of the city streets, particularly in Genoa, into nearly every part of which we penetrated. Paris has the reputation of being clean, but the narrower streets in Paris are foul compared with the Genoese by-ways, and to a New Yorker the proceedings of an Italian street-cleaning department must seem like a revelation. We had occasion to go through one of the busiest and dirtiest streets in Genoa, close to the docks, closely resembling, in point of situation and traffic, West Street in New York. I suppose almost every one has waded through the West Street mud, and climbed over its heaps of garbage, and most people who have been there in hot weather have probably also noted, with gratified surprise, the energy of the street-cleaning department in occasionally depositing a handful of chloride of lime on top of each of the largest garbage-heaps. In the Genoese West Street, under the government of the hand-organ grinders, there was no trace of either garbage-heaps or mud. The pavement could not, in the nature of things, be kept dry, but it was swept as clean as birch brooms could make it, and, to remove the last vestage of offence, it was dusted from side to side and from end to end with chloride of lime, put on either in fine powder or in a thin emulsion, I could not tell which. The narrower streets, all of which are paved with square stones, were continually patrolled by the uniformed sweepers of the "*pulizia delle strade*," and every cheese-paring and cabbage-stump thrown out from the houses and shops was promptly transferred to the carts which followed them, and we could walk without annoyance from one end of the city to the other, through streets varying from eight to ten feet in width, and lined with tenement-houses six or seven stories high, at a time of year when such a walk in New York would threaten one with suffocation.

We happened, by the tram-car conductor's choice rather than our own, to be landed at the door of a hotel which was, so to speak, born a palace, and had only recently been degraded to the use of tourists. I am obliged to speak with difidence of its history, being far away from my Fergusson, but we learned from the hotel waiters that the building was once one of the Brignole palaces, and I seemed to recognize in it, on studying the outside from a distance, a resemblance to one of the illustrations in Fergusson's "*History of Architecture*," representing, if I recollect rightly, what he calls the "little Brignola Palace." I think the drawing of the "little Brignola" palace shows it with a low open loggia on each side, which certainly does not exist in the hotel; but the building is now closely hemmed-in by other structures, and the loggias, which would have been suitable to the position of the palace when the Piazza Deferrari, on which it stands, was a garden, may have been removed to make way for improvements.

However that may be, the hotel-palace is still a beautiful building both inside and outside. Although small in comparison with the enormous palaces beyond it on the same street, its three stories seem to have been more easily brought into proportion than their five, and the exterior detail appeared to me the most elegant that I saw on any of the palaces, most of which are either rather bare, or overloaded with questionable ornament. Inside, the building was richer than on the outside, and much of the work was probably modern, but the general effect was excellent. Being the only strangers in the house, we were assigned rooms on the second story, which rather overwhelmed us by their air of decayed magnificence. The larger of the two rooms had once been about thirty feet wide by forty feet long, but a strip had been cut off one end by a thin partition, to form a passageway. The ceiling was coved on three sides, the cove of the fourth side being in the passageway, and the central portion seemed to rise slightly, forming a very flat dome. As nearly as I could measure it, the height from the floor to the top of the cove was twenty-two feet. The ceiling had been redecorated rather cheaply when the alterations were made, and the floor, which was originally like the floors which still remained in the halls and the other rooms in that story, of bits of marble set in cement, had been painted over to conceal its dilapidation with a dark red color, sprinkled with white from a brush. Our smaller room, which seemed to have undergone little alteration, was once apparently either an ante-room or a boudoir, attached to the large one. It was of about the same height as the other, but long and narrow, and ceiled with an elliptical vault, the whole of which, together with the walls down to the height of the wainscot, was covered with plaster decoration in relief. The style of the work was perhaps a trifle exuberant, but the effect of the wreaths of flowers and the cherubs nearly half-life size, which sprawled over the walls, was, to our unaccustomed eyes, very rich and gay. What the original coloring may have been I cannot say, the whole being now painted white, with a little tinting here and there, but from the circumstance that two frames were formed in the centre of the principal wall-surfaces, in which were still set what purported to be family portraits, I suppose that much of the work must have been originally gilded. In the large reading-room on the first story, which was also long and narrow, and had an elliptical ceiling decorated in the same way, the reliefs were nearly all gilded, while the panels were filled with extremely pretty and rich flower and figure painting. The walls of the reading-room, however, instead of rococo panelling were divided by coupled pilasters between which were set mirrors occupying all the space not taken up with windows or doors. The Roman mosaic, as we call it, of broken pieces of colored marble, up to an inch square, set in hard gray or red cement, and rubbed down with a flat stone and sand to a level surface, covered all the principal floors, as well as the stair-landings in the building, the stairs themselves being of white marble. It is usual with us to leave such pavements, after they are once laid, to their own sense of propriety as to keeping themselves clean, sometimes, perhaps, washing them with water or milk, but we discovered that those at Genoa, which had a remarkable polish, were waxed and rubbed regularly, just like an oak floor.

The situation of the hotel gave us an excellent opportunity for observing one of the most amusing of Genoese sights, the morning market. Under the city regulations certain public squares are allowed to be occupied every morning until nine o'clock by the retail venders of vegetables, fruit, eggs and such things, who, in other towns are accommodated in the great market-halls. The Piazza Deferrari is one of the public places so used, and soon after daylight the dealers, most of whom were women, began to arrive, carrying baskets of oranges, cherries, apricots, cabbages, potatoes, eggs, mushrooms, live snails, and other delicacies, together with coarse cloths which they spread on the pavement and utilized for displaying their merchandise. There was food for the mind as well as the body, at least half-a-dozen baskets of second-hand books always contending for space with the turnips and onions, while heaps of bandana handkerchiefs, coarse lace, fans, calicoes, soap and cheap fancy goods, gave variety to the exhibition. By seven or eight o'clock nearly every foot of the pavement was covered either with the market-people and their goods, or with their customers, who moved about sometimes with their own baskets on their arms, and sometimes with servants following them to carry their purchases. Simple as the affair was, the color and movement of the crowd made the scene a very picturesque one, and one spectator, at least, was extremely sorry when the clock struck nine, and, as the last stroke of the bell died away, the delegates of the Street Polishing Department made their appearance in the square. Beginning at the side next the street, they advanced, swinging their brooms, and the market melted away before them. The potato-men and the orange-women, the book-sellers and snail-dealers, hastily gathered up their goods and retreated homeward, and in ten minutes not a cabbage-leaf or peach-stone was left in the square to tell of the busy scene which had occupied it all the morning. To me there was something wonderful in this vigorous cleanliness, The Genoa of my mind had always been an unsavory place, ragged, tawdry and pretentious. Instead of that, I found the real town neat and orderly beyond anything that I had ever seen, filled, not with shabby old palaces, but with houses which, at the worst, always made a tolerably successful effort to look dignified, and showing indications in every direction of prosperity and happiness. Of my old friend with the red pantaloons and the guitar there was no trace, but in place of him were troops of bright-looking children, who apparently spend their time, not in lounging about grape arbors, but in good,

[1] Continued from page 48, No. 553.

hard work in the numberless schools which, ranging from the kindergarten to the "Marine and Technical Institutions" for boys, were to be seen on all sides; and, although there was less sentiment about their little uniforms than in his rolling eyes, I could not say that I regretted his absence, or that the Genoese had less reason now to be proud of their city than in the days when they put up the arms of Genoa, where they still remain over the chancel-arch of their great cathedral, in the place where other people put the cross. In fact, Northwestern Italy generally seems to be full of enterprise and prosperity. From Ventimiglia to Milan, and in the vacant spaces around both cities, we saw new houses, manufactories, wharves and engineering works everywhere. North of Milan, on the shore of Lake Maggiore, a new railroad connecting this with Lake Como, was on the point of being opened to the public, and we saw constantly from the diligence, in going from Pellanza to the Simplon, the splendidly finished constructions of the great road which is about to pierce the mountains with the fourth Alpine tunnel, to connect the railway system of Eastern France with that of Italy.

THE ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

CHICKERING HALL, FIFTH AVENUE, NEW YORK, N. Y. MR. GEORGE B. POST, ARCHITECT, NEW YORK, N. Y.

[Gelatine Print, issued only with the Imperial Edition.]

SKETCHES OF PORTUGUESE ARCHITECTURE.—I. BY MR. C. H. BLACKALL, ARCHITECT.

FOR description see article elsewhere in this issue.

OLD COLONIAL WORK, NOS. XI AND XII. DETAILS FROM TRINITY CHURCH, NEWPORT, R. I. MEASURED AND DRAWN BY MESSRS. F. E. WALLIS AND E. G. HARTWELL.

COMPETITIVE DESIGNS FOR A $5,000-HOUSE, SUBMITTED BY "*Novel*" AND "*W.*"

FOR the jury's comments, see elsewhere in this issue.

AMERICAN ARCHITECT COMPETITION FOR HOUSE COSTING $5,000.[1]—IV.

"*IX.*"—Novelist not isolated. Waste room in hall. Kitchen in basement requires extra servant. Details are not good, but general mass of house is excellent, simple, direct, and well proportioned. Porch perhaps a little light. Rendering is unskilful.

"*W.*"—Plan compact and good. No especial provision for use of bedrooms as nurseries. Design of exterior wants study in proportions, is somewhat bald and somewhat too high in second story. Details are good and rendering is good.

"*A Starter.*"—Novelist is not isolated. Plan fairly good otherwise. No constructive details. Interior designs crude and coarse. Exterior much better. The design could, by slight simplifications, such as leaving out the plaster and mock-timber work in gables, giving up an exterior chimney, be made into a good and satisfactory house. Rendering is not good, has a crude, rough look, principally caused by too black shadows badly cross-hatched.

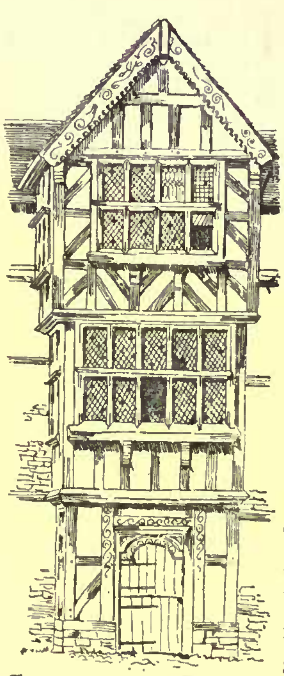
Novel.—A basement kitchen is objectionable for reasons already stated. The study is over the kitchen and would be uncomfortable from both smell and noise. Details are overdone, especially in gables. Stair balusters have very poor turnings. The concave forms used in staircase and in dormer windows are always bad. Exterior lacks quiet, is spotty. Roof too small for walls and whole house is too much cut up. Rendering of plans good, lettering poor. Rendering of perspective clear but spotty. No light and shade.

[To be continued.]

[1] Continued from page 50, No. 553.

SAFE BUILDING.[2]—VI.

RULES FOR CALCULATING TRANSVERSE STRAINS.



FROM AN OLD HOUSE. LUDLOW, ENG.
AFTER SKETCH BY E J MAY AA SKETCH BOOK, LONDON.

1. *Find Reaction of each Support.*

Summary of Rules. IF the loads on a girder are uniformly or symmetrically distributed, each support carries or reacts with a force equal to one-half of the total load. If the weights are unevenly distributed, each support carries, or the reaction of each support is equal to, the *sum* of the products of *each* load into its distance from the *other* support, divided by the whole length of span. See Formulæ (14), (15), (16), and (17).

2. *Find Point of Greatest Bending Moment.*

The greatest bending moment of a uniformly or symmetrically distributed load is always at the centre. To find the *point* of greatest bending moment, when the loads are unevenly distributed, begin at either support and pass over load after load until an amount of loads has been passed *equal* to the amount of reaction at the support from which the start was made, and this is the desired point. In a cantilever the point of greatest bending moment is always at the wall.

3. *Find the Amount of the Greatest Bending Moment.*

In a beam (supported at both ends) the greatest bending moment is at the centre of the beam, provided the load is uniform, and this moment is equal to the product of the whole load into one-eighth of the length of span, or

$$m = \frac{u.l}{8} \qquad (21)$$

Where m = the greatest bending moment (at centre), in lbs. inch, of a uniformly-loaded beam supported at both ends.

Where u = the total amount of uniform load in pounds.

Where l = the length of span in inches.

If the above beam carried a central load, in place of a uniform load, the greatest bending moment would still be at the centre, but would be equal to the product of the load into one-quarter of the length of span, or

$$m = \frac{w.l}{4} \qquad (22)$$

Where m = the greatest bending moment (at centre), in lbs. inch, of a beam with concentrated load at centre, and supported at both ends.

Where w = the amount of load in pounds.

Where l = the length of span in inches.

To find the greatest bending moment of a beam, supported at both ends, with loads unevenly distributed, imagine the girder cut at the point (previously found) where the greatest bending moment is known to exist; then the *amount* of the bending moment at that point will be equal to the product of the reaction (of either support) into its distance from said point, less the *sum* of the products of *all* the loads on the *same* side into their respective distances from said point, *i. e.*, the point where the beam is supposed to be cut. To check the whole calculation, try the reaction and loads of the discarded side of the beam, and the same result should be obtained.

To put the above in a formula, we should have:—

Amount of greatest bending moment.

$$m_A = p.x - \Sigma\,(w_I\, x_I + w_{II}\, x_{II} + w_{III}\, x_{III}, \text{ etc.}) \qquad (23)$$

And as a *check* to above:

$$m_A = q.(l-x) - \Sigma\,(w_{IIII}\, x_{IIII} + w_V\, x_V + w_{VI}\, x_{VI}) \text{ etc.} \qquad (24)$$

Where A = is the point of greatest bending moment.

[2] Continued from page 9, No. 549.

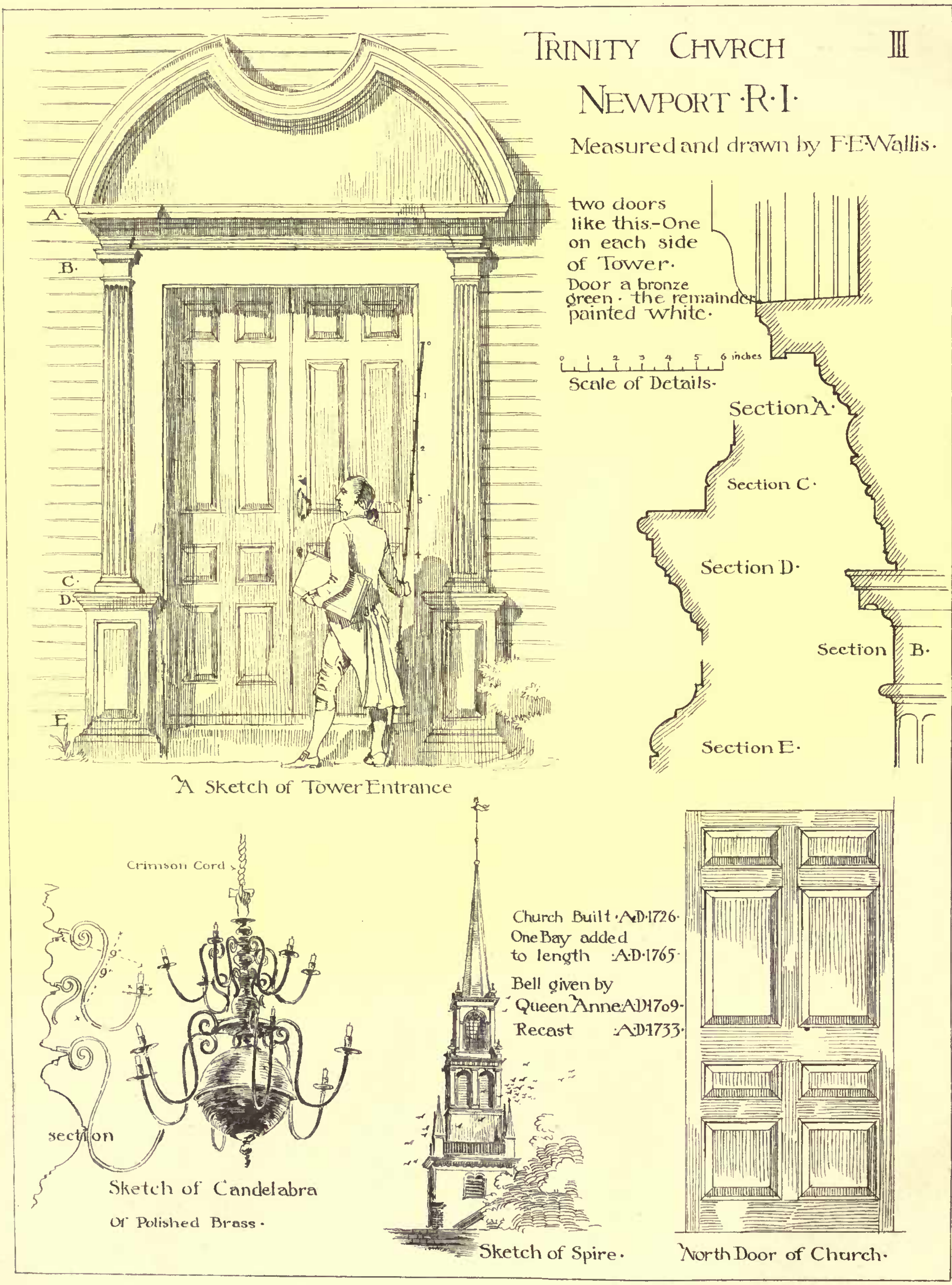
GLOSSARY OF SYMBOLS.—The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.:—

a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
f = *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g_I = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches. [See Table I.]
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right-hand re-action* (or support) of beams, in pounus.
r = *moment of resistance*, in inches. [See Table I.]
s = *strain*, in pounds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
𝔡 = *diameter*, in inches.
𝔯 = *radius*, in inches.
π = 3.14159, or, say, 3.1-7 signifies the *ratio of the circumference and diameter of a circle.*

If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_I, a_{II}, a_{III}, etc., or b, b_I, b_{II}, b_{III}, etc.

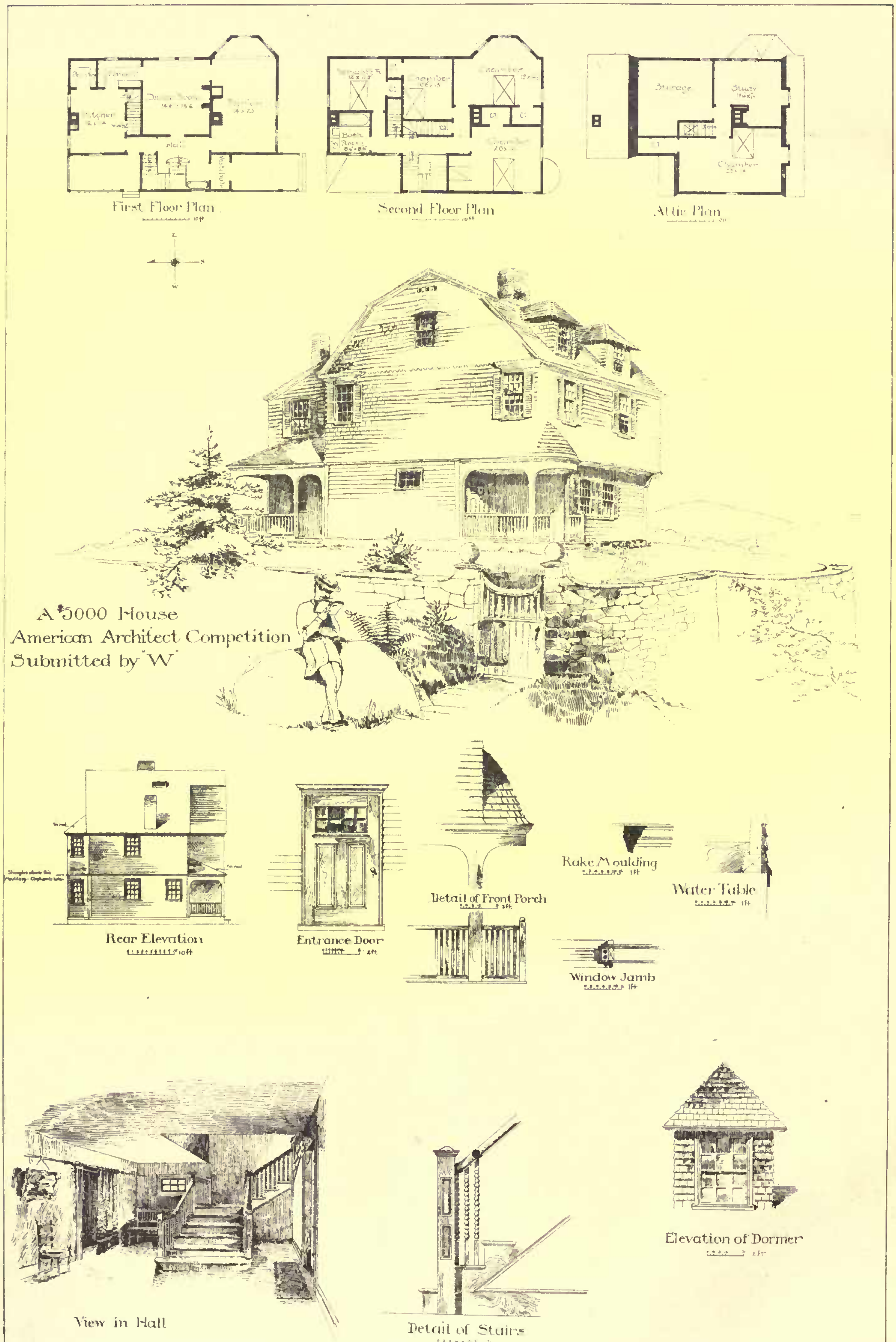
In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance:—

m = moment or bending moment at *centre*.
m_A = " " " *point A.*
m_B = " " " *point B.*
m_X = " " " *point X.*
s = strain at *centre*.
s_B = " *point B.*
s_X = " *point X.*
v = stress at *centre*.
v_D = " *point D.*
v_X = " *point X.*
w = load at *centre*.
w_A = " *point A.*



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Old Colonial Work, XI.

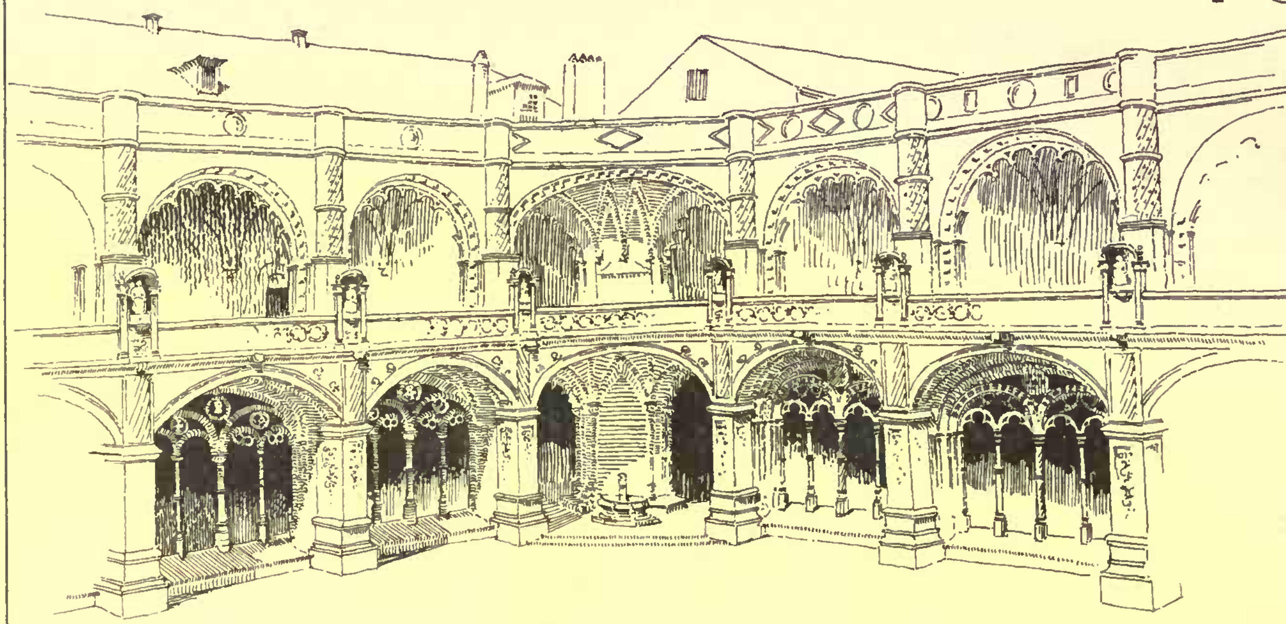


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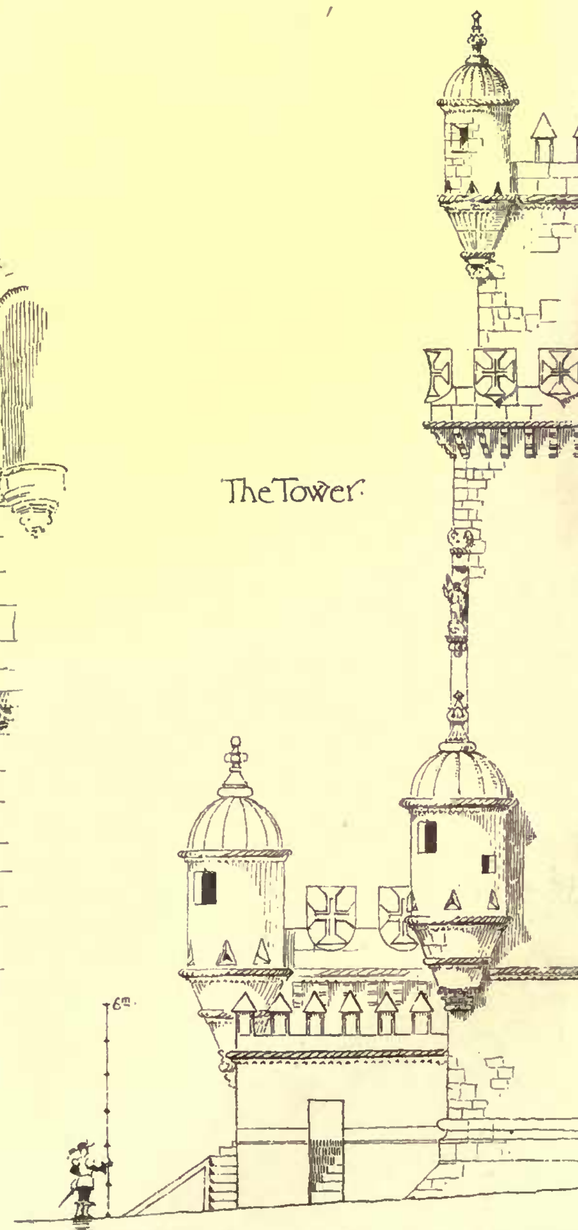
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The Cloisters.



A detail of the Monastery.



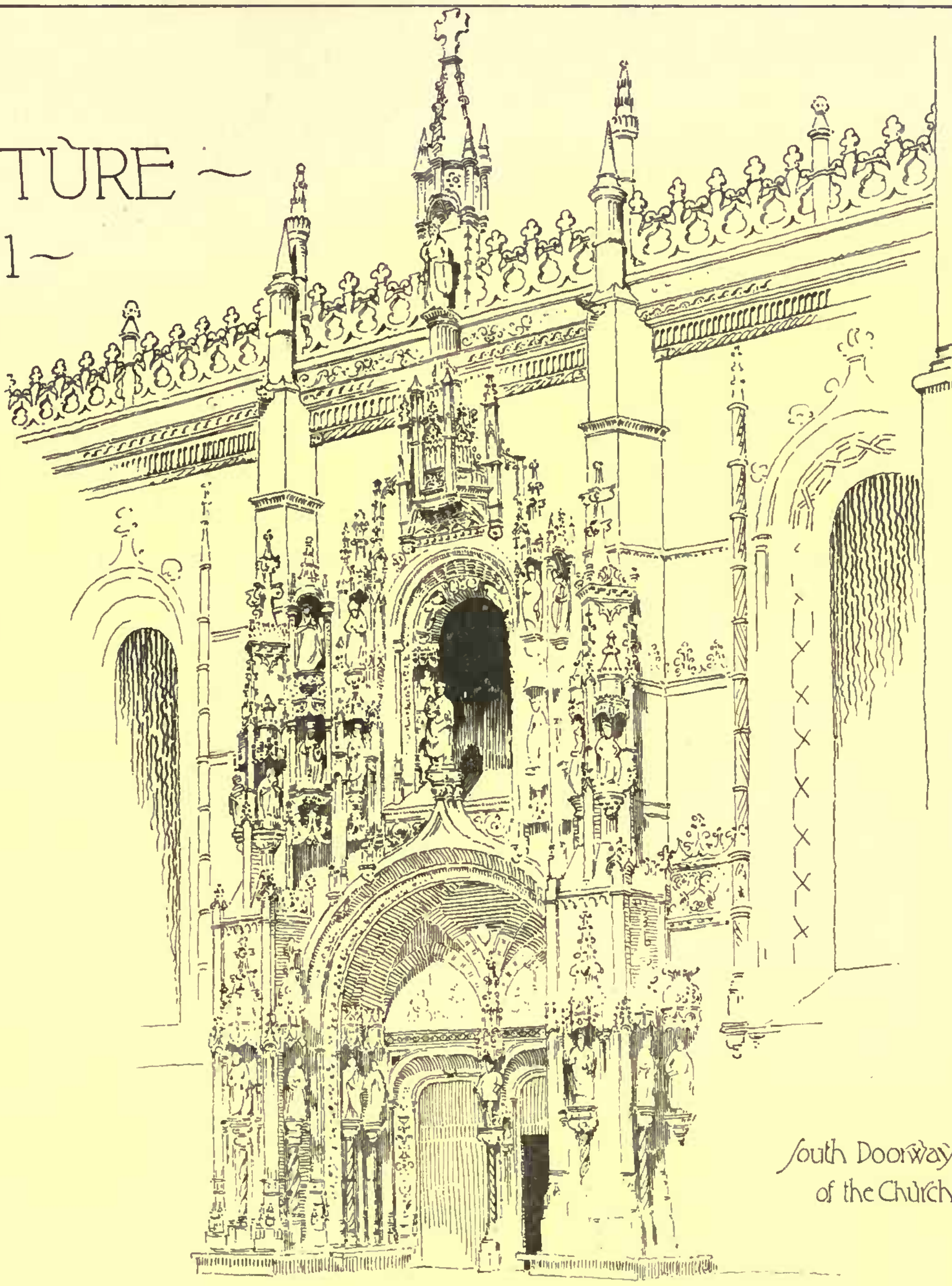
The Tower.

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…GUESE ARCHITECTURE ~
~ No. 1 ~

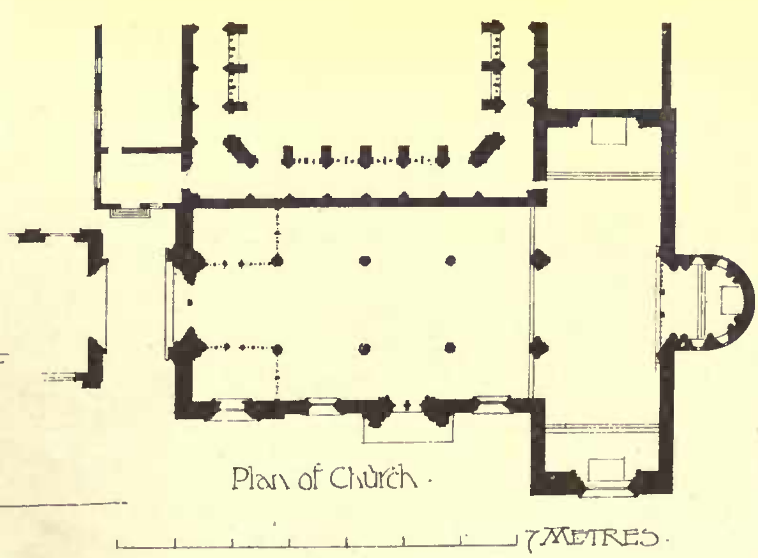
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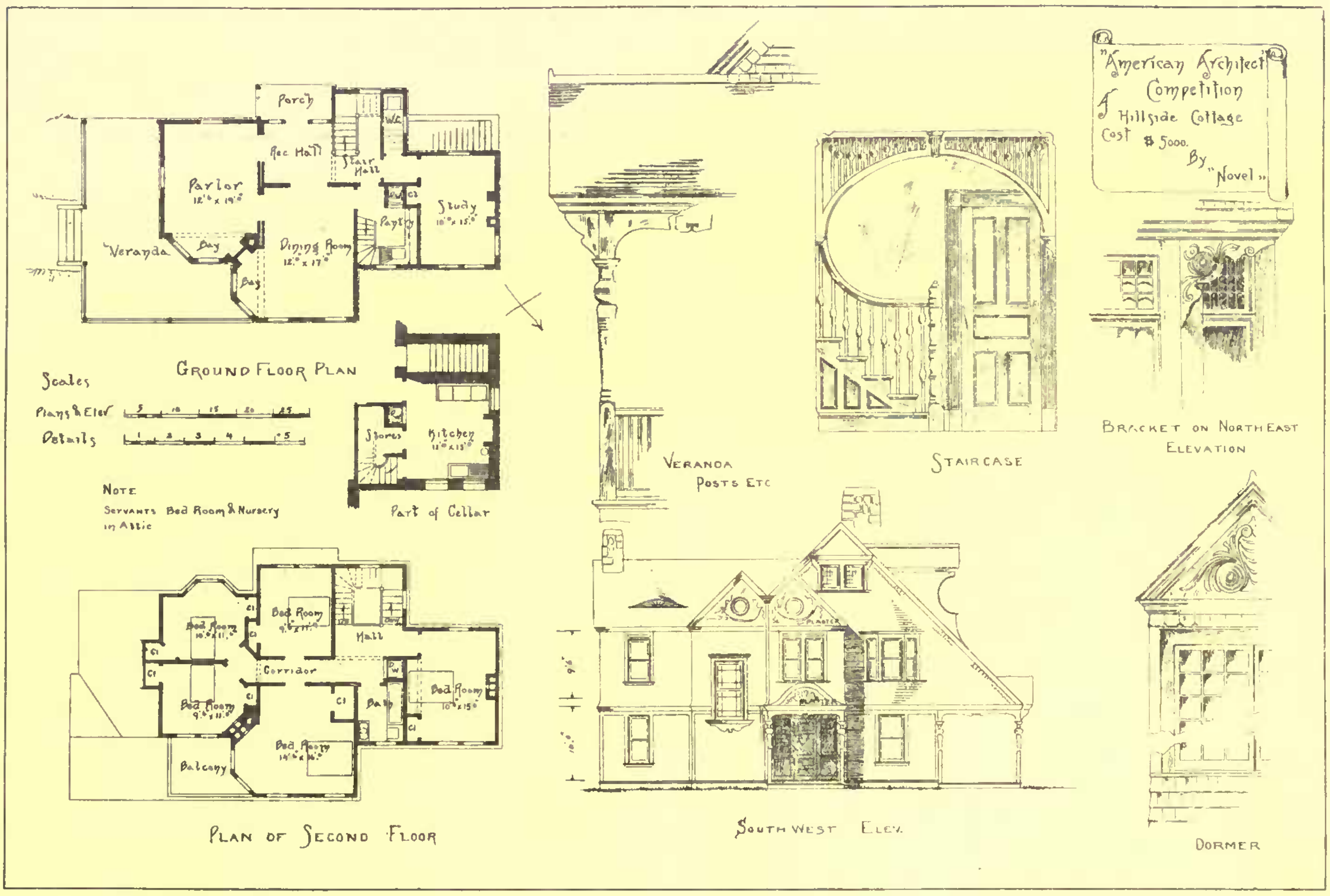
South Doorway of the Church·

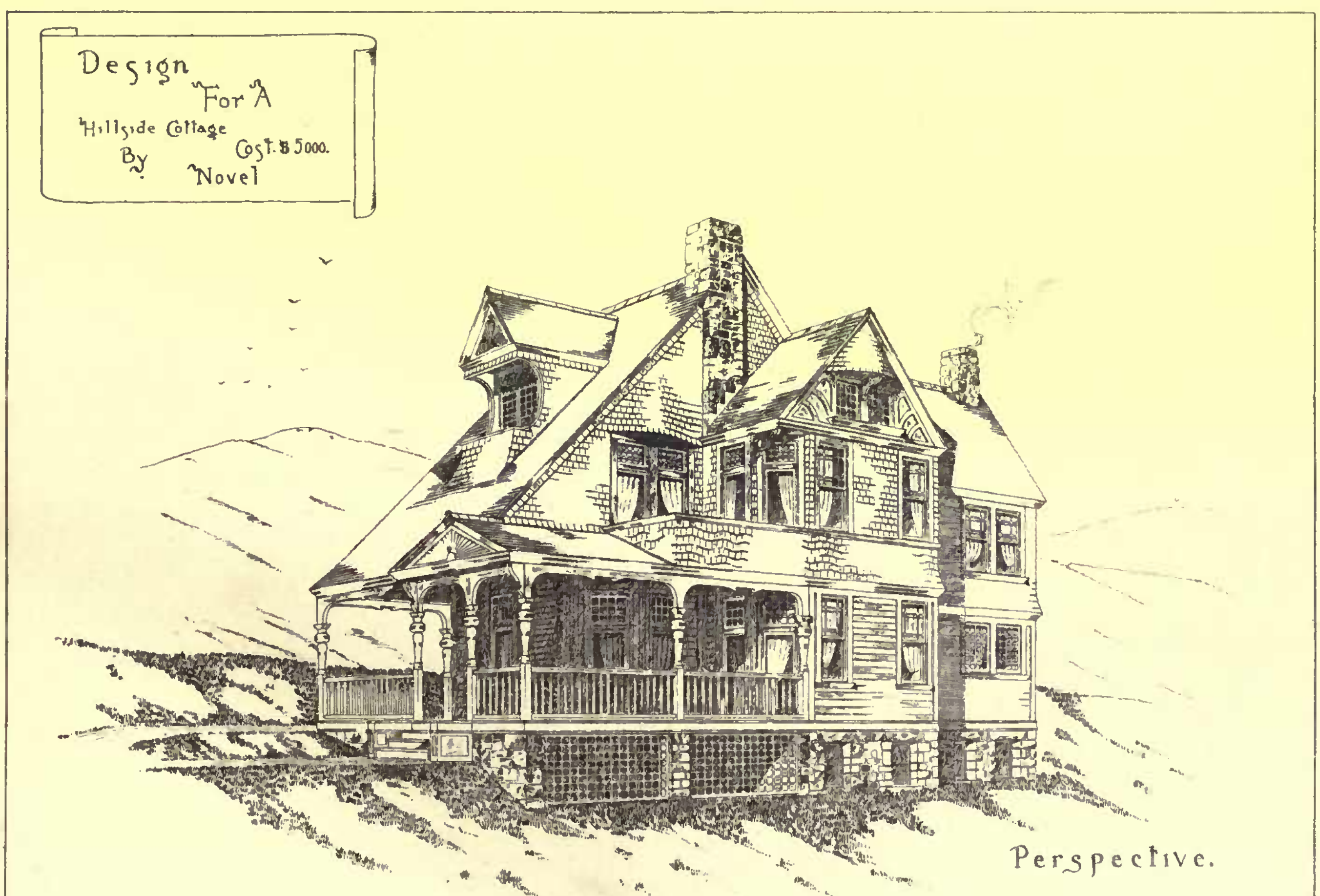




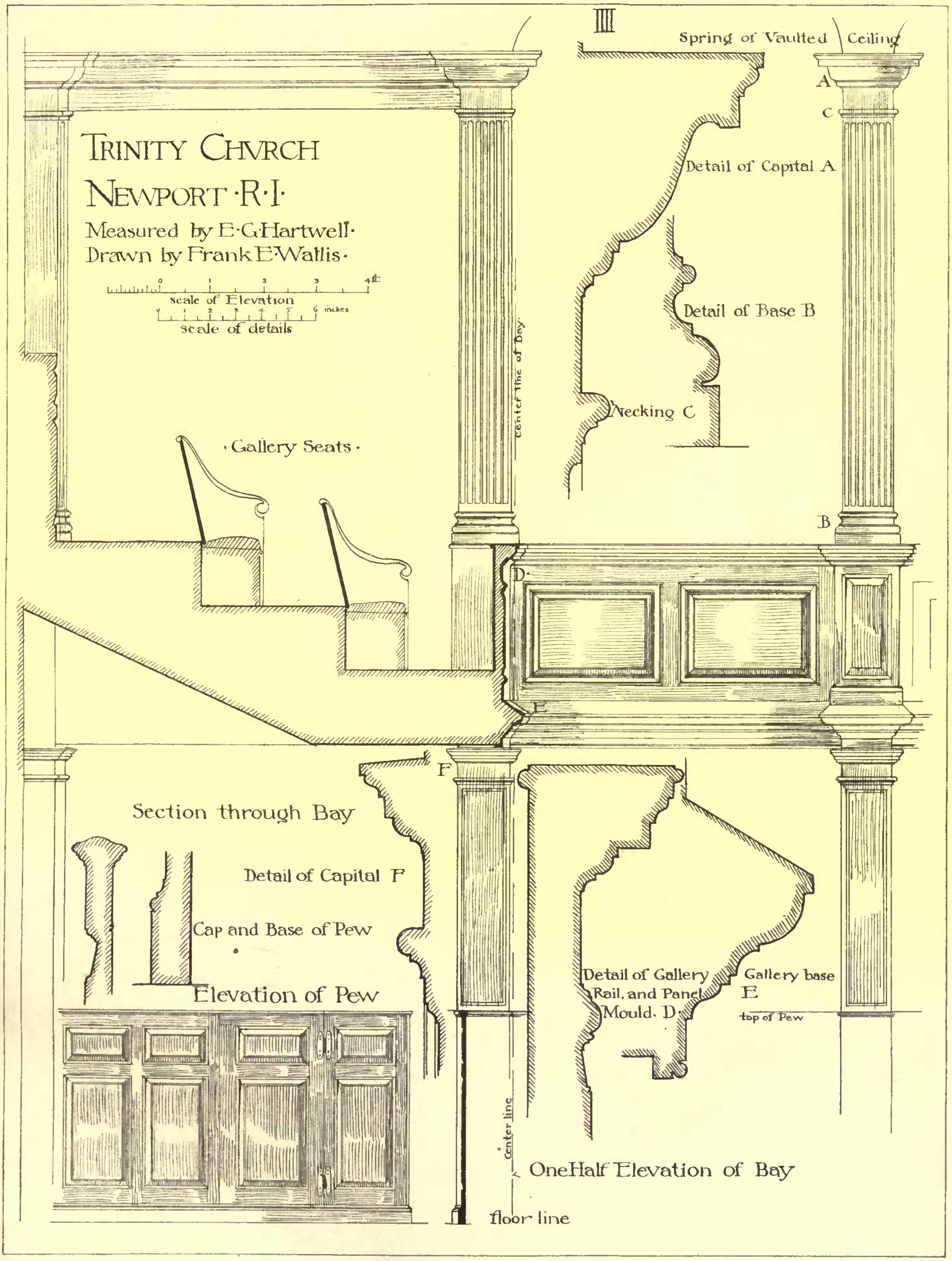
Plan of Church·

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Old Colonial Work, XII.

Where m_A = is the amount of bending moment, in lbs. inches, at A.
Where p = is the left-hand reaction, in pounds.

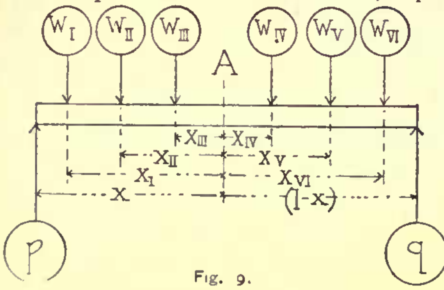


Fig. 9.

Where q = is the right-hand reaction, in pounds.

Where x and $(l-x)$ = the respective distances in inches, of the left and right reactions from A.

Where x_{I}, x_{II}, x_{III}, etc., = the respective distances, in inches, from A, of the loads w_{I}, w_{II}, w_{III}, etc.

Where w_{I}, w_{II}, w_{III}, etc., = the loads, in pounds.
Where Σ = the sign of summation.
The same formulæ, of course, would hold good for any point of beam.

In a cantilever (supported and built in at one end only), the greatest bending moment is *always* at the point of support.

For a uniform load, it is equal to the product of the whole load into one-half of the length of the free end of cantilever, or

$$m = \frac{u.l}{2} \qquad (25)$$

Where m = the amount, in lbs. inch, of the greatest bending moment (at point of support).
Where u = the amount of the whole uniform load, in pounds.
Where l = the length, in inches, of the free end of cantilever.

For a load concentrated at the free end of a cantilever, the greatest bending moment is at the point of support, and is equal to the product of the load into the length of the free end of cantilever, or

$$m = w.\,l \qquad (26)$$

Where m = the amount, in lbs. inch, of the greatest bending moment (at point of support).
Where w = the load, in pounds, concentrated at free end.
Where l = the length, in inches, of free end of cantilever.

For a load concentrated at any point of a cantilever, the greatest bending moment is at the point of support, and is equal to the product of the load into its distance from the point of support, or

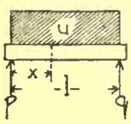
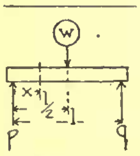
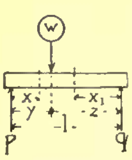
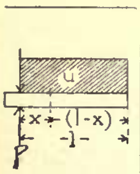
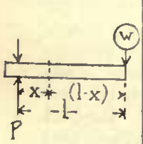
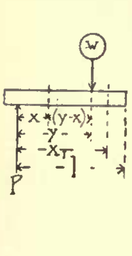
$$m = w.\,x \qquad (27)$$

Where m = the amount, in lbs. inch, of the greatest bending moment (at point of support).
Where w = the load, in pounds, at any point.
Where x = the distance, in inches, from load to point of support of cantilever.

Note, that in all cases, when measuring the distance of a load, we must take the shortest distance (at right angles) of the vertical

TABLE VII.

BENDING-MOMENT (m) AND AMOUNT OF SHEARING-STRAIN (s) OF BEAMS AND CANTILEVERS FOR VARIOUS LOADS.[1]

Manner of Loading.	Description.	m and s at centre.	m and s at any point distant x from support p.	Location and amount of greatest bending-moment m.	Location and amount of greatest shearing-strain s.	Location and amount of greatest deflection δ.
	Uniform load on beam supported at both ends.	$m = \frac{u.l}{8}$ $s = o$	When x greater than $\frac{l}{2}$ use $(l-x)$ in place of x. $m = \frac{u}{2}.x.\left(1 - \frac{x}{l}\right)$ $s = u.\left(\frac{1}{2} - \frac{x}{l}\right)$	at centre $m = \frac{u.l}{8}$	at support p or q. $s = \frac{u}{2}$	at centre $\delta = \frac{5}{384}.\frac{u.l^3}{e.i}$
	Load at centre of beam supported at both ends.	$m = \frac{w.l}{4}$ $s = o$	$m = \frac{w}{2}.x$ $s = \frac{w}{2}$	at centre $m = \frac{w.l}{4}$	at support p or q $s = \frac{w}{2}$	at centre $\delta = \frac{1}{48}.\frac{w.l^3}{e.i}$
	Load at any point on beam supported at both ends.	If y greater than $\frac{l}{2}$: $m = \frac{w.z}{2}$, $s = \frac{w.z}{l}$ If y smaller than $\frac{l}{2}$: $m = \frac{w.y}{2}$, $s = \frac{w.y}{l}$	At load use: $m = \frac{w.y.z}{l}$, $s = o$ For x use: $m = \frac{w.z.x}{l}$, $s = \frac{w.z}{l}$ For x_1 use: $m = \frac{w.y.x_1}{l}$, $s = \frac{w.y}{l}$	at load $m = \frac{w.y.z}{l}$	at nearer support p If y smaller than $\frac{l}{2}$ $s = \frac{w.z}{l}$ at support q. If y greater than $\frac{l}{2}$ $s = \frac{w.y}{l}$	at load $\delta = \frac{w.y.z}{9.l.e.i}.\sqrt{\frac{y.(l+z)^3}{3}}$
	Uniform load on cantilever.	$m = \frac{u.l}{8}$ $s = \frac{u}{2}$	At free end use: $m = o$, $s = o$ For x use: $m = \frac{u.(l-x)^2}{2.l}$, $s = \frac{u.(l-x)}{l}$	at support p $m = \frac{ul}{2}$	at support p $s = u$	at free end $\delta = \frac{1}{8}.\frac{u.l^3}{e.i}$
	Load at free end of cantilever.	$m = \frac{w.l}{2}$ $s = w$	At free end use: $m = o$, $s = o$ For x use: $m = w.(l-x)$, $s = w$	at support p $m = w.l$	at support p $s = w$	at free end $\delta = \frac{1}{3}.\frac{w.l^3}{e.i}$
	Load at any point of Cantilever.	If y greater than $\frac{l}{2}$: $m = w.\left(y - \frac{l}{2}\right)$, $s = w$ If y smaller than $\frac{l}{2}$: $m = o$, $s = o$	If $x = y$ use: $w = o$, $s = o$ If x_1 greater than y use: $m = o$, $s = o$ If x smaller than y use: $m = w.(y-x)$, $s = w$	at support p $m = w.y$	at support p $s = w$	at load $\delta = \frac{1}{3}.\frac{w.y^3}{e.i}$

(1) If a beam supported at both ends and loaded uniformly will safely carry an amount of load $= u$; then will the same beam:

(2) if both ends are built in solidly and load uniformly distributed, carry $1\frac{1}{2}.u$,

(3) if one end is supported and other built in solidly and load uniformly distributed, carry $1.u$,

(4) if both ends are built in solidly and load applied in centre, carry $1.u$,

(5) if one end is supported and other built in solidly and load applied in centre, carry $\frac{3}{4}.u$,

(6) if both ends are supported and load applied in centre, carry $\frac{1}{2}.u$,

(7) if one end is built in solidly and other end free (cantilever) and load uniformly distributed, carry $\frac{1}{4}.u$,

(8) if one end is built in solidly and other end free (cantilever) and load applied at free end, carry $\frac{1}{8}.u$.

That is, in cases (1), (3) and (4) the effect would be the same with the same amount of load; in case (2) the beam could safely carry $1\frac{1}{2}$ times as much load as in case (1); in case (5) the beam could safely carry only $\frac{3}{4}$ as much as in case (1), etc., *provided that the length of span is the same in each case.*[2]

If the amount of deflection in case (1) were δ_{I} then would the amount of deflection in the other cases be as follows:

Case (2) $\delta_{II} = \frac{1}{5}.\delta_{I}$
Case (3) $\delta_{III} = \frac{2}{5}.\delta_{I}$
Case (4) $\delta_{IV} = \frac{2}{5}.\delta_{I}$
Case (5) $\delta_{V} = \frac{3}{4}.\delta_{I}$
Case (6) $\delta_{VI} = 1\frac{3}{5}.\delta_{I}$
Case (7) $\delta_{VII} = 9\frac{3}{5}.\delta_{I}$
Case (8) $\delta_{VIII} = 25\frac{3}{5}.\delta_{I}$

[2] To count on the end of a beam being built in solidly would be very bad practice in most cases of building construction; as, for instance, a wooden beam with end built in solidly could not fall out in case of fire, and would be apt to throw the wall. Even where practicable, it would require very careful supervision to get the beam built in properly; then, too, it causes upward strains which must be overcome, complicating the calculations unnecessarily. In most cases where it is necessary to "build in" beam ends, the additional strength and diminished deflection thereby secured had better be credited as an additional margin of safety. The above rules for deflection do not hold good if the beam is not of uniform cross-section throughout; the deflection being greater as the variation in cross-section is greater.

[1] All measurements in inches; all weights in pounds; e = modulus of elasticity in pounds inch; i = moment of inertia of cross-section of beam or cantilever around its neutral axis in inches; m = bending-moment in pounds inch; s = amount of shearing strain in pounds; δ = total amount of deflection in inches.

neutral axis of the load, (that is, of a vertical line through the centre of gravity of the load.)

4. *Find the Required Cross-section.*

To do this it is necessary first to find what will be the required moment of resistance.

If the cross-section of the beam is *uniform* above and below the neutral axis, we use Formula (18), viz.: —

$$r = \frac{m}{\left(\frac{k}{f}\right)}$$

If the cross-section is *unsymmetrical*, that is, not uniform above and below the neutral axis, we use for the *fibres above the neutral axis*, formula (19), viz.: —

$$r = \frac{m}{\left(\frac{c}{f}\right)}$$

and for the *fibres below the neutral axis*, Formula (20), viz.: —

$$r = \frac{m}{\left(\frac{t}{f}\right)}$$

In the latter two cases, for economy, the cross-section should be so designed that the respective distances of the upper and lower edges (extreme fibres), from the neutral axis, should be proportioned to their respective stresses or capacities to resist compression and tension. This will be more fully explained under cast-iron lintels.

A simple example will more fully explain all of the above rules.

Example.

Three weights of respectively 500 *lbs.*, 1000 *lbs.*, *and* 1500 *lbs.*, *are placed on a beam of* 17′ 6″ (*or* 210″) *clear span*, 2′ 6″ (*or* 30″), 7′ 6″ (*or* 90″), *and* 10′ 0″ (*or* 120″) *from the left-hand support. The modulus of rupture of the material is* 2800 *lbs. per square inch. The factor-of-safety to be used is* 4. *The beam to be of uniform cross-section. What size of beam should be used?*

1. *Find Reactions* (*see formulæ* 16 *and* 17).

Reaction p will be in pounds, $= \frac{500.180}{210} + \frac{1000.120}{210} + \frac{1500.90}{210} =$ $1642\frac{6}{7}$ pounds.

Reaction q will be in pounds, $= \frac{500.30}{210} + \frac{1000.90}{210} + \frac{1500.120}{210} =$ $1357\frac{1}{7}$ pounds.

Check, $p + q$ must equal whole load, and we have in effect: —

$$p + q = 1642\tfrac{6}{7} + 1357\tfrac{1}{7} = 3000, \text{ which}$$

being equal to the sum of the loads is correct, for: —

$$500 + 1000 + 1500 = 3000.$$

2. *Find Point of Greatest Bending Moment.*

Begin at p, pass over load 500, plus load 1000, and we still need to pass $142\frac{6}{7}$ pounds of load to make up amount of reaction p ($1642\frac{6}{7}$ lbs.); therefore, the greatest bending moment must be at load 1500; *check*, begin at q and we arrive only at the first load (1500) before passing amount of reaction q ($1357\frac{1}{7}$ lbs.), therefore, at load 1500 is the point sought.

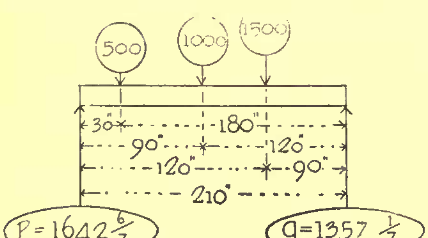


Fig. 10.

3. *Find Amount of Greatest Bending Moment.*

Suppose the beam cut at load 1500, then take the left-hand side of beam, and we have for the bending moment at the point where the beam is cut.

$$\begin{aligned} m &= 1642\tfrac{6}{7}.120 - (500.90 + 1000.30 + 1500.0) \\ &= 197143 - (45000 + 30000 + 0) \\ &= 197143 - 75000 \\ &= 122143 \text{ lbs. inch.} \end{aligned}$$

As a check on the calculation, take the right-hand side of beam and we should have: —

$$\begin{aligned} m &= 1357\tfrac{1}{7}.90 - 1500.0 \\ &= 122143 - 0 \\ &= 122143 \text{ lbs. inch,} \end{aligned}$$

which, of course, proves the correctness of former calculation.

4. *Find the Required Cross-section of Beam.*

We must first find the required moment of resistance, and as the cross-section is to be uniform, we use formula (18), viz.: —

$$r = \frac{m}{\left(\frac{k}{f}\right)}$$

Now, $m = 122143$, and $\frac{k}{f} = \frac{2800}{4} = 700$, therefore,

$$r = \frac{122143}{700} = 174{,}49 \text{ or say } = 174{,}5$$

Consulting Table I, fourth column, for section No. 2, we find

$r = \frac{bd^2}{6}$, we have, therefore,

$$\frac{bd^2}{6} = 174{,}5 \text{ or } bd^2 = 1047.$$

If the size of either b or d is fixed by local conditions, we can, of course, find the other size (d or b) very simply; for instance, if for certain reasons of design we did not want the beam to be more than 4″ wide, we should have

$$b = 4, \text{ therefore, } 4.d^2 = 1047, \text{ and}$$

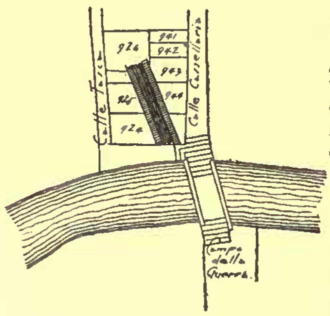
$$d^2 = \frac{1047}{4} = 262, \text{ therefore, } d = \text{(about) } 16'',$$

or, if we did not want the beam to be over 12″ deep, we should have

$$d = 12, \text{ and } d^2 = 12.12 = 144, \text{ therefore,}$$

$$b.144 = 1047, \text{ and } b = \frac{1047}{144} = 7{,}2'' \text{ or say } 7\tfrac{1}{4}''.$$

AN ANCIENT VENETIAN SEWER AND MODERN DRAINAGE.



At the beginning of the present year, in laying the foundations of a new house at S. Lio, near the Ponte della Guerra, a sewer was discovered, which from its size, its form, the materials of which it is composed, and the depth at which it was found, must be considered an ancient one.

The extrados of the barrel-vault which covers the sewer was found at a depth of 0.21 metres below the high-water level. The top of the new piling only reached the springing of the said vault, but in certain parts, it having been necessary to excavate the ground, the level of the bottom was reached at 2.51 metres below the high-water level.

The internal dimensions of the sewer are 1.95 metres in width and 2.15 in height. The bottom is formed of boards of oak and pine, four or five centimetres thick, and laid crosswise; on the ends of these are set the side walls, diminishing on the outside, and made of sandstone in roughly quarried blocks. The vault, formed of small bricks, 0.155 × 0.08 × 0.048 metres each, is 35 centimetres thick for about half its curve, and it is reduced to one brick in thickness at the top.

The mortar, of white Istrian lime, *broada*, that is slaked at the moment of use, is identical with that of our most ancient buildings, and the same may be said for the sandstone and the oak. As for the pine, one of our wild kinds (*sylvestris* or *maritima*), it is not surprising to find it in an ancient Venetian construction, when we remember what a great extension the pine-woods (*pinete*) had on our shores. The sewer at S. Lio was completely filled up by a black deposit, which when cut by the shovel seemed like pitch,[1] a proof of long use and of a still longer period passed since it was abandoned, for when its communication with the canal was cut off it became full, yet the pine boards of its bottom were not rotted nor impregnated, so that on splitting one of them the interior of the wood was found of a bright reddish-yellow color, and seemed to preserve the resin as when it was first cut.

The bricks are the so-called *altinelle*, which were brought by the Venetians from the ruins of Altino, when they took refuge on the islands of the lagoon, and in our buildings of the Byzantine time we find continually these small bricks, to which the mortar of Istrian lime has never adhered, and which are found already crushed or are easily broken, showing a mixture of dirty and ill-baked clay.

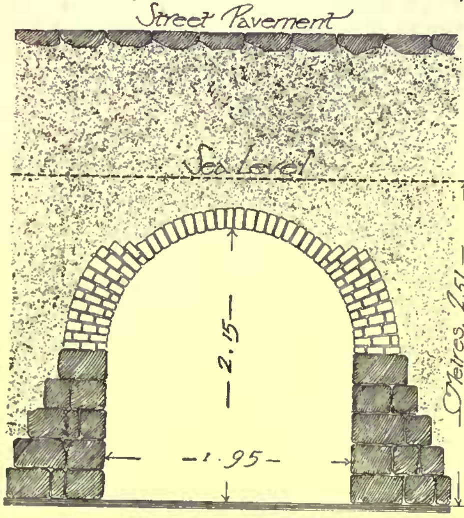
If the materials of this sewer correspond with those of the most ancient Venetian buildings that have come down to us, we have another and curious indication of antiquity in the fact that the sewer forms an angle of about 30° with the line of the adjoining street, and therefore penetrates in an oblique direction under the foundations of the houses, or rather has been broken and divided when the said foundations were constructed, a proof that it existed previously to those buildings or to their present arrangement. Beyond the first houses the sewer turns in the direction of the street, and the island of S. Lio, bounded by the Canal della Guerra and by that of S. M. Formosa, was by it divided nearly in the centre.

It is worth while noticing the special care taken in the construction of this sewer, and if its result was diminished by an execution which left something to be desired, this happened rather through the inexperience than the carelessness of the builders. The wood bottom passing under the side walls bound them together. These walls, with external footings, present the best conditions of stability, and do not take up the space in the drain. The barrel-vault springs with a thickness corresponding to that of the walls, and keeps this for a space sufficient to avoid the danger of breaking by lateral thrust, and is then reduced in thickness, in order also to facilitate a periodical demolition in some parts.

When we compare this ancient sewer with the modern street-drains,

[1] Some curious objects have been found imbedded in it, among them several spoons of gilt metal and one of ashwood, with a Gothic mark on its handle.

we notice the greater size of the early one, a fact not new in the history of construction. The Romans of the time of the Kings built the Cloaca Maxima, *receptaculum omnia purgamentorum Urbis*, a construction to which, according to Livy (I, lvi, 2), the later constructions could scarcely be compared. This primitive sewer of Venice is only half the width of that of Rome, but in a city formed of islands joined together, the public sewers, limited in their length by the canals, could not reach the dimensions which are characteristic of the Roman sewer and of analogous constructions in modern cities.



The ancient Venetian sewers, of which this example has been preserved, were useful more than anything else for maintaining, and indeed assisting the circulation of the sea-water in our subsoil. Long centuries have passed, and to us moderns, instead of the primitive methods suggested, we may almost say, by instinct, have been handed down customs consecrated by habit, and of which new experiences suggest the modification.

Some of the Venetian houses now have a separate cesspool, which allows more or less filtration into the surrounding earth; the houses along the canals, on the other hand, make use of these as sewers, and hence result serious inconveniences, partly counteracted by the regulation that their openings shall be below the level of low water, which does not prevent their being completely exposed at the time of the very low tides, together with the accumulations formed here and there at the bottom of the canals, so that at certain times these are canals only in name: "*re vero cloaca fœdissima, quæ sicut turpis et immundissima adspectu, ita pestilens et odore teterrimo.*" [1]

In order to remove these inconveniences I have proposed the abolition of a direct discharge into the canals. "It will suffice to remember the great number of houses provided with separate cesspools (I wrote in the *Gazzetta di Venezia*, on the 31st of May, 1885), in order to ask one's self how it is that other private dwellings, for the sole reason that they are situated on the edge of a public canal, or communicating with it, should arrogate to themselves the privilege of making use of it as their dust-heap or worse. The canals of Venice are not less public than the streets; the same regulation of public cleanliness should therefore prevail for both the former and the latter. Indeed, whatever is thrown or discharged into a canal by private individuals costs the public the additional expense of dredging, while there is also an offence against the public right and the laws of hygiene."

In December last our Municipal Council voted a tax on the drains in proportion to the injury which they cause to the canals, and this encouraged the construction of cesspools, but their construction and emptying yet remain to be regulated. Many things are to be observed with regard to the construction of the cesspools; the worst of their inconveniences is their effect upon the subsoil of a house or a whole city after a length of time, where also air circulates and returns to the surface together with exhalations, where some infectious germs find conditions favorable to their development or reproduction. However great may be the disinfecting action of the ground on which human habitations are standing, like that of cemeteries, after a certain time the agents of reduction become exhausted.

From the purely hygienic point of view, the innocent custom of the fishing population of some of our islands, which throws everything into the canals, where the salt water, a solvent *par excellence* and universal disinfectant, does all the rest, is preferable to the use of cesspools in ground already saturated.

The inconveniences of the cesspools would be removed by making them impermeable, or by surrounding them with a stratum of good earth. In the special case of Venice, where the sea-water itself is a substitute for the earth, we must consider its disinfecting properties and what is its action in filtering through the permeable strata of our subsoil, and how this action may best be utilized for the common good, without meaning in this way to speculate on the cleanliness of our canals. The cesspools which were surrounded by sea-water or by ground in which sea-water freely filtered would act better than those presumedly impermeable.

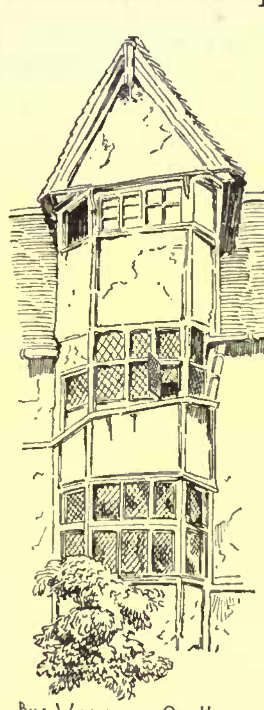
The ancient sewer of S. Lio contributes to the solution of this problem, recalling how the ancient Venetians, even when treating of islands not large in extent, divided and subdivided the subsoil with artificial drainage, precisely the contrary of that which is often done by the modern ones in filling up the canals with mud and rubbish.

GIACOMO BONI.

[1] Plin. *Sec. ad. Trajan, Imp.*, X, 99.

THE BIRCH.

THE birch coming under our consideration we shift the scene to America, that land of arboreal wonders. Our notice is there fixed, so far as the importance of the wood is concerned, on the *Betula lenta*, otherwise the black birch, cherry birch, Canada birch, sweet birch, or mountain mahogany of the Americans, the *Bouleau merisier* of the French community, and the Quebec birch, etc., of the English merchants. It is a tree of rapid growth, attaining an altitude of seventy or eighty feet, with a diameter of thirty to even thirty-six inches, and a trunk fairly straight, of thirty or even forty feet in length.



BAY WINDOW ON OL. HOUSE. (ENGLAND.)
AFTER SKETCH BY E. WEBB.
AA SKETCH BOOK. LONDON.

It is a native of Canada to Georgia, abounding in Nova Scotia, the district of Maine, and the State of Vermont. It is also plentiful near New York, in Pennsylvania and Maryland. Farther South it ascends the Alleghenies, and is found throughout their whole range, to its termination in Georgia. In loose, cool, deep soil, on the steep, shady banks of mountain rivers, it attains its largest size.

The tree is peculiar in possessing a greyish bark resembling that of the cherry tree, and hence its name of "cherry birch." Its flowers are very fragrant, and its leaves, especially when bruised, emit a sweet odor; this fact has no doubt suggested their use as tea, and the name, as applied to the tree, of "sweet birch."

The wood of this birch is the most valued in the trade. When grown on rich or suitable soil, it is, when newly cut, of a rosy hue, which deepens by exposure, and hence it has taken up the name of mountain mahogany. The grain is fine, close, and capable of a high polish, the wood is hard and strong, fairly durable, and practically free from mechanical disintegration by the action of the worm or furniture beetle. The American birch, although uniformly plain is occasionally figured. In this state it is known as "curled birch," the richest specimens being of sufficient value to warrant their being cut into veneers. Although the birch is bright colored in its dry state, it becomes a dullish brown, a fact that confines its use as an ornamental wood to bedroom furniture.

As a cheap hardwood the birch has, for many years been the staple commodity of the cabinet-maker, and it largely enters into other wood-consuming trades. Forty years ago it was used in the building trade, in a stained form, as a substitute for mahogany; but owing to the uniform cheapness of mahogany at the present time, it has, for this purpose, fallen into disuse. It is imported in logs six feet to twenty feet in length, and twelve to thirty inches square, always with more or less wane; and, occasionally, especially in what is called "low port" shipments, crooked and taper. The Quebec shipments, although the shortest specifications, are the largest squares and the best colored wood. The other shipments, carrying more wane and faults, are uniformly of lighter color. America possesses what appears to us an unlimited supply of this wood, but the cost of transmission in many cases is too great to admit of its being brought to the European market. It is largely used in Massachusetts, Connecticut and New York, where it is next in esteem to the wild cherry.

Another species of the American birch is the *Betula excelsa*, the tall birch, or the yellow birch, the latter name being drawn from the epidermis, or outer layers of bark, being a golden yellow. This tree abounds in the forests of Nova Scotia, New Brunswick, and the district of Maine. It is rare in New Jersey and Pennsylvania, and is confounded with *Betula lenta*, which is abundant there. It is a tree attaining a height of sixty to seventy feet, with a diameter of two feet, and is common to most kinds of soil. The wood is inferior in quality and color. It is, however, strong, and is used for many purposes to which that of *Betula lenta* is applied. In Canada it is used for parts of vessels always under water, for frames of sledges, yokes of cattle, etc. The young saplings are used as hoops for casks, and the wood generally as fuel. Like most of the birch species the bark is used for tanning.

The wood of this yellow birch was formerly imported into Ireland and Scotland in boards and planks, which were used for joinery purposes; but it is now mostly imported in the form of hewn logs, as an ingredient in the common or low port shipments. We must give a passing note to *Betula nigra*, the black birch, or red birch, found in Virginia and North Carolina. The wood of this tree is nearly white, and it is used for purposes to which poplar is generally applied. We cannot hear of its entering into the export trade.

We must close our notice of the great subject of birch by reference to the *Betula papyracea*, of America, otherwise the paper birch, the white birch, or the canoe birch. It is a large tree, a native of the northern districts, notably of the Hudson Bay Territory.

It is a tree of seventy feet in height, with a diameter of three feet, but instances are by no means rare of its attaining double this diameter. The wood is reddish-brown in the heart, and white on the sap, fairly strong, with a fine glossy grain. This tree produces curls in the forks of the branches, which are used by the cabinet-makers of Boston and other Northern towns. Like the birch species in general it forms an excellent fuel; but its wood soon decays where alternations of moisture and heat are present.

AMERICAN BIRCH BARK.

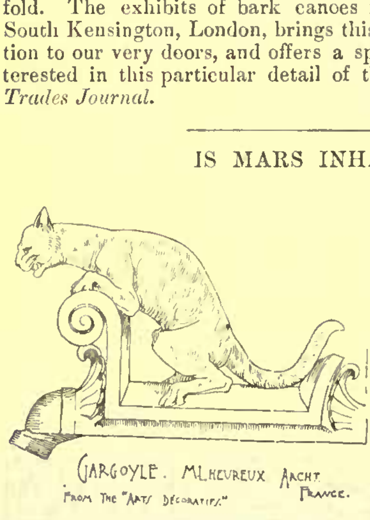
The American continent is far more rich in species and varieties of birch than Europe; but, with one exception, the bark has little or no resemblance thereto. The most valued bark is that of *Betula papyracea*, the great birch of the North, or Hudson Bay Territory. Upon the rising of the vernal sap the bark of this tree is incised in lengths of about twelve feet, trees about three feet in diameter being chosen. Sheets are thus produced twelve feet long and nine feet broad; but for economy in handling they are taken off in two sheets of about four feet each.

The uses to which this fine bark is applied are similar to those common in the North of Europe. It is divided into thin sheets as a substitute for paper; it is used in roofing under shingles, for baskets, boxes, portfolios, soles of shoes, crowns of hats, and as a defence against humidity generally. It lends itself with great freedom to ornament, and is often embroidered with silk, and other fibres of varied colors. It is to the making of canoes and tents that this bark is mainly applied; for these purposes the sheets, selected from large, smooth-barked trees are stitched together with fibrous roots of the white spruce, about the size of a quill; these fibres are barked and rendered supple by steeping, and the seams, in the case of canoes, are coated with gum from the balm of Gilead fir.

These bark canoes are greatly used by the Indians and French Canadians in making long journeys into the interior, their extreme lightness being a great consideration in carrying from one lake to another. So far as their carrying capacity is concerned, we learn that some of them accommodate fifteen passengers, and that a canoe to carry four persons and their baggage will not weigh above forty or fifty pounds. The "rind tents," made of this useful material, are the admiration of all travellers and hunters in Canada; they are extremely light and portable, and a circular tent twenty feet in diameter and ten feet high can be pitched in half an hour. These tents are used all the year round; but they are the most pleasant in June, July and August.

The import of this remarkable bark has been suggested, and we have no doubt a good trade therein might be done; for as a cheap impervious material, obtainable in large sizes, its use would be manifold. The exhibits of bark canoes in the Colonial Exhibition at South Kensington, London, brings this remarkable material production to our very doors, and offers a splendid reference for those interested in this particular detail of the wood trade. — *The Timber Trades Journal.*

IS MARS INHABITED?



GARGOYLE. M. L'HEUREUX ARCHT.
FROM THE "ARTS DÉCORATIFS." FRANCE.

A WRITER in *Chambers' Journal* says:

Some time ago it was observed that situated at each pole of Mars there is a white patch, which increases and decreases at regular intervals. This had been observed for many years before the explanation was suggested by Herschel that it was due to the freezing of the sea, and was exactly analogous to our Arctic and Antarctic Oceans. If this was true the patch of ice would of course decrease in the Martial summer and increase again as the winter came on. This was soon shown to be the fact. Thus we see as far as regards tbe sea Mars is very similar to our earth, with the exception that the proportion of land is much larger. On the earth the land is only about one-third of the area of the sea; while on Mars, the land and sea surfaces seem to be about equal in extent. The land is much cut up by the water, which exists not so much in the form of a few large oceans, but rather as a number of curious shaped narrow inlets and channels, which intersect the continents in all directions. The bright red color of the land is a curious fact for which no adequate explanation has as yet been suggested. Herschel considered it was due to the peculiar nature of the soil; but it certainly seems curious that in this point Mars should differ from all the other planets. The appearance of the earth seen from a similar distance would probably be a dirty green, or perhaps brown. In fact, on the earth we have no soil or rock, which occurs in any quantity, of the red color which we observe on Mars. There is therefore no vegetation, unless we adopt the curious theory advanced by a French savant that on Mars the foliage is red. Unluckily, we have no instrument that can at all help us here; the telescope and spectroscope are alike useless, and for the present we must content ourselves with vain conjectures.

The next point that ought to engage our attention is the atmosphere, without which no life is possible.

Without entering into calculations, we may state that the pressure of the air at the surface of Mars would be about equal to five inches of mercury, or about one-sixth of the normal atmospheric pressure on the earth.

Now, given an atmosphere and a large extent of sea, we would naturally expect that clouds would form a prominent feature on the Martial surface; and observation has proved this to be the case.

The air on Mars being much less dense than on the earth, it is presumable that the winds would move with much greater velocity; and for this reason it has been thought that trees could not grow to any considerable height. We must, however, bear in mind that, though the velocity would be high, the actual force of the wind would probably not be very great, on account of its excessive tenuity.

In an inquiry as to the probability of the existence of life, one of the most important points to be taken into account is the amount of heat available. Now, Mars is at such a distance from the sun that on the whole it would receive about two-fifths as much solar heat as we do. This does not, however, give the amount of heat that is actually received on the surface of the planet, a considerable proportion being absorbed by the atmosphere; and since our atmosphere is so much denser and thicker than that of Mars, it follows that we lose a much larger percentage of the solar heat. To calculate the exact amount of heat absorbed by a given thickness is a very difficult, if not impossible, problem; but it seems likely that, taking everything into account, the inhabitant of Mars will receive more heat from the sun than we do. This would have the effect of making the evaporation very large, and if so, the Martial atmosphere would be mostly composed of water vapor.

According to Professor Langley, the true color of the sun is blue, and its yellowness is due to the dirt always present in the air. To the inhabitants of Mars, it would most probably appear nearly white, unless, indeed, they also have volcanoes to fill the air with lava dust.

Let me now sum up the facts we have stated, and determine as far as we can what sort of man the inhabitant of Mars must be.

In the first place, the force of gravitation at the surface is only just over one-third of its equivalent on the earth; a pound would therefore weigh about six ounces in Mars. If, therefore, we assume that the men are of such a size that their weight and activity are the same as ours, they would be about fourteen feet high on the average. This would make their strength very great; for not only would it be actually superior to ours, but, as every weight is so much smaller it would be apparently proportionally increased. We should, therefore, expect to find that the Martialites have executed large engineering works; perhaps also their telescopes are much superior to ours, and we have been objects of interest for their observers. With regard to telescopes, it may be interesting to examine what is the effect of the highest magnifying power we can use. At his nearest approach, the distance from us to Mars is about 37,000,000 miles; and assuming that the highest power that can be used with advantage is 1,200, we approach with our telescopes to a distance of 30,000 miles, so that houses or town, or indeed, any artificial works, would be hopelessly invisible. With regard to the supply of heat and light, we have seen that the Martialite is not worse off than we are. To him the sun would appear as a white or perhaps blue disk, about two-thirds of the diameter that it appears to us. The Martial day differs but slightly from ours; his year, however, is much longer, being about 687 of our days, which is about 650 Martial days. The inclination of his axis to the plane of the orbit is such that his seasons would be very similar to ours. It is difficult to reconcile the idea of an extensive vegetation with his peculiar red color; it is just possible, however, that some of the green patches generally supposed to be seas may in reality be large forests.

The most valid objection to the habitability of Mars lies in the fact of the extremely low atmospheric pressure, which, as we have seen, would probably average about five inches of mercury. The lowest pressure that a man has ever lived in, even for a short time, is about seven inches, which was reached by Coxwell and Glaisher in their famous balloon ascent. The aeronauts, however, narrowly escaped perishing, not only on account of the low pressure, but also because of the extreme cold.

It seems impossible that a man constituted exactly as we are could live for any length of time breathing air only one-sixth of the density of ours. But it is rather going out of our way to assume that the Martialites would be exactly the same as we are in every way; the chances are a million to one against it; and on the other hand, a very slight modification of the lung arrangement would suffice to make life perfectly possible under such conditions.

The nights on Mars would be very dark, for he has no satellite like our moon. He has, it is true, two moons, but they are so small that their illuminating power is *nil*, being respectively only sixty and forty miles in diameter. The smallest of these presents the curious phenomenon that it revolves round Mars faster than the planet turns on its own axis, and therefore would appear to rise in the west and set in the east.

Our earth, as seen from Mars when at his nearest, would appear about the same size as Jupiter does to us—that is to say, would subtend an angle of about forty seconds. At his farthest distance, this would be reduced to fourteen.

We thus see that there is ample reason for assuming that this, the most interesting of all the planets, is the abode of creatures not

essentially different from ourselves. Being considerably older than we are, the Martialites are probably much further advanced in the arts and sciences; and perhaps there may be some truth in the story of the Italian astronomer who says he has lately detected lights on the planet moving about in such a way as seems to indicate a deliberate intention to open communication with the earth. What the language of the lights is, we have not been informed; let us hope it is something more practical than the proposal of the Russian savant to communicate with the moon by cutting a huge figure of the forty-seventh proposition of Euclid on the plains of Siberia, which, he said, any fool would understand.

THE PARIS MUNICIPAL LABORATORY.



TOWER OF LE CHÂTEAU DIEPPE FRANCE.
AFTER SKETCH BY C. H. LEHR.

THE Paris Municipal Laboratory is well represented at the exhibition of urban hygiene now open at the Lobau Barracks. The arrangements made allow every one interested to follow minutely the work done and the progress made by this useful institution. The analyses made by the municipal laboratory are, on an average, 16,500 yearly, of which there are 7,000 wine specimens, 4,500 milk. The service includes a *chef*, an assistant *chef*, two principal chemists, twenty-three assistant chemists, twenty inspectors, and four clerks. The hygienic importance of water investigations is now universally admitted. The laboratory practices the biological test in water analyses; this is based upon the culture of microbes in gelatine. These cultivations are made in flat-bottomed, conical glass bottles; two tubes are placed in the cork, one with a glass top and another plugged with cotton wool; the process commences by rendering the bottles sterile in an iron stove capable of resisting two atmospheres, and large enough to contain one hundred and fifty of these receptacles. This stove is exhibited, as well as its vapor generator, which is utilized to distil water for laboratory use; 10c. of gelatine are afterward introduced into the bottles; this is sterilized at a temperature of 150° 110; they are ready for use. At the moment they are required for use, the gelatine is liquefied by means of slight heat, and the water to be tested, diluted with a sufficient quantity of pure water, is poured through the tube provided with a tap. The gelatine solidifies in the process of cooling. The receptacles are arranged in a large metal chest with glass doors, in which the temperature is maintained by means of a thermosiphon. The bacteria develop and give birth to colonies which form as many spots as there are bacteria contained in the volume of water used. Wine is more carefully inspected by the laboratory authorities, and more often tested at the laboratory than any other food substance, in consequence partly from the number of wine-shops in the capital, and partly from the facility with which wine can be adulterated by dishonest tradesmen in order to increase their profits. At the exhibition whoever pleases can witness the series of operations to which the wine analysed is submitted. First, the density is taken by means of a Houdart's oinobarometer; the quantity of alcohol it contains is determined by distillation in an apparatus, in which four wine samples can be tested at the same time by means of an ebullioscope, an instrument founded upon the difference existing between the two forms of boiling water and alcohol diluted with water. At the municipal laboratory department of the urban exhibition there are different models of these instruments; those of M. Malligand, Dr. Perier, and M. Amagat; also a particular kind of pipette, which fills automatically, and serves to measure exactly twenty cubic centimetres of wine, and the different methods of testing which serve to determine the proportion of extract, of ashes, of tartar, of sulphate, and of acid. The proportion of extract is determined in flat-bottomed cylindrical platinum capsules, which are warmed in special water-baths. They are afterwards left to cool in drying cages before being weighed in precision scales. The extract is ascertained by allowing the wine to evaporate in a vacuum obtained by different means. The extract is then incinerated in a large gas-stove (*fourneau à moufle*); the ashes are then weighed. The proportion of sugar is ascertained by Fehling's test. The proportion of acid, tartar, and "*plissage*" are ascertained by reagents of unvarying strength contained in bottles of a special form. Color intensity is determined by Duboscq's chronometer, founded upon the comparison of light which has travelled up to different heights in the fluid. After wine, of which Paris consumes 1,400,000 litres a day, the most important substance is milk, of which the consumption is about 250,000 litres. The different processes of the analyses of milk are exhibited. The density of the milk is first examined by the lactidensimeter, then the cream is allowed to rise, and its height is measured by the creamometer, by means of a pipette analogous to that used for the wine analyses, then ten cubic centimetres of milk are measured and introduced into the flat-bottomed platinum capsules. This milk evaporated at 95° in a hot-air stove, gives the extract, which is weighed and incinerated. A fresh sample of ten cubic centimetres is introduced into one of Marchand's lacti-butyrometers and mixed with pure alcohol. It is then heated in a special water-bath, and the height and quantity of butter which is separated is thus marked, and therefore easily estimated. Preserved vegetables are frequently colored green by using copper. It is not necessary here to discuss the question of their harmlessness.

The municipal laboratory does not only practise chemical methods for solving the many problems submitted to it, it also verifies the purity of alcohols and oils by means of a refractometer which is brought to such a degree of perfection that it determines without calculation, and in a few minutes, the coefficient of the refraction of fluids. The density of coffee and of all groceries is determined by a new volumenometer which is easily used. A special apparatus is used for extracting from the articles of food those substances which are soluble in alcohol and ether. A special kind of spectroscope is used, and a table showing the spectrum of absorption of the principal coloring substances due to the researches of MM. Ch. Girard and Pavot can be consulted. The microscopic preparations of adulterated food preparation are photographed by a magnificent apparatus. Numerous specimens obtained from the archives of the laboratory show that excellent results are arrived at with flour, pepper, vegetable sections, and diatomaces. A part of the exhibition is set aside for apparatus for making gas analyses; amongst them are drying-machines, gas-extractors, for sewage, also several other instruments for estimating the density of gas, either by the quickness with which it escapes, or according to M. Charcot's method.—*Sanitary Record.*

COMMUNICATIONS

[*We cannot pay attention to the demands of correspondents who forget to give their names and addresses as guaranty of good faith.*]

BOOKS ON FRAMING.

CLINTON, MASS., July 27, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — Will you kindly favor me, through the columns of your very valuable paper, with the name and price of some reliable work on modern house-framing, both balloon and full frame? and oblige, Yours very truly, H. F. STIMPSON.

[PERHAPS the book as much to your purpose as any is "*Hatfield's American House Carpenter*," published by John Wiley & Son, New York; price, we believe, $3.00. Tredgold's "*Carpentry*," and Nicholson's "*Joiner's Assistant*" are standard and useful works.—EDS. AMERICAN ARCHITECT.]

H. K. BROWN'S STATUE OF GEN. GREENE.

NEWPORT, R. I., July 27, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,— I have just read your notice of H. K. Brown. You have made one mistake, unless I am misinformed. I am quite sure he made the equestrian bronze statue of General Greene in Washington, which seems to me to be the best equestrian statue in America, and *much* the best bronze horse, I know.

Faithfully, GEO. E. WARING.

[IN mentioning the most important of Mr. Brown's works, we were under the impression that the statue of General Greene, mentioned in the records to which we referred for information, was a standing statue within some building, possibly the Capitol. On looking up the matter more closely, we find that Colonel Waring is quite right as to the fact, and fully justified in the opinion he expresses as to the merit of the equine member of the group. Both the horse which bears General Greene, and the one that upholds the ponderous weight of General Scott, are admirable animals, and more like the American saddle-horse of to-day than any other bronze horses in the country. In the case of General Greene's horse, however, we think the sculptor has committed an anachronism, as we do not believe that the horse he bestrides is of his day and time.—EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

THE LATE PRINCE TORLONIA.— Visitors to Rome of late years often saw driving in an unpretending carriage, or devoutly attending mass at St. Mark's church, a man of venerable but strange appearance, who, by his aspect seemed to belong to a bygone generation. He might almost have been taken for one of those pensioners who may still be seen in remote almshouses, rare survivors of the energetic reforms of the Charity Commissioners. He was always to be seen dressed in a long snuff-colored coat reaching nearly to his heels, cut after the fashion in vogue in 1820, a large, double-breasted waistcoat, and trousers fitting closely to the leg, but spreading out bell-shaped over the foot. His wristbands, limp and starchless, hung down far beyond the sleeves of his coat, and on his head he wore one of those genuine old beaver hats dear to our grandfathers before the age of silk. In cold weather he was wrapped in a cloak that might well have scandalized the eyes of a modern tailor. It was confidentially affirmed that the owner had worn it for nearly sixty years, ever since he made his first trip to London in 1829. A strange figure this was to meet in the last quarter of the nineteenth century even in Rome, where strange sights are even now common. Yet any one that had an eye to see would have been more struck by the features of the man than by his clothes. The heavy beetling brows, the keen eyes, the square-cut mouth and determined chin could hardly belong to a man without a history. The question, Who is this? was pretty sure to raise to your lips on seeing him, and no passer-by

but could answer the question at once, for Prince Torlonia had, during many years, been a notable character in Rome. He was the chief member of a family whose name had for more than half a century been to Romans a synonym for wealth, luck and liberality. Even the Rothschilds could no more than vie with the Torlonias in their rapid rise from poverty to opulence and their magnificent expenditure of a huge income. The story of that rise can be told in a few words. In 1780, when the Ancien Régime was drawing to a close, two brothers, Marino and Jean Torloni, herdsmen in what is now the department of the Puy-de-Dome, finding life hopeless under the grinding oppression of their noble lord, left their home to seek their fortune in Paris. There they started humbly in business, opening a small shop for the sale of second-hand wares, but by dint of constant attention and of that inflexible economy which is so characteristic of the French peasant, they so prospered that at the end of ten years they were able to make a successful tender for a contract as purveyors to the army of Italy. With that army they reached Rome in 1792, but the hardships of the march proved too much for the elder brother, and he died a few days after entering the city. Jean Torloni, now alone in the world, continued to prosper. With judicious patriotism he supplied the French troops without pressing for immediate payment, and thus won the confidence and esteem of Hugh Basserville, French Ambassador in Rome; so much so that one day, as the tale runs, the Ambassador sending for him, said: "I have here a large sum of gold in my charge which I dare not keep in my own house, for I have a presentiment that I shall soon be assassinated and robbed; I intrust it to you for safe keeping." Torloni took the money, and within a few days Basserville died, as he had forboded, and the money remained as a deposit on trust in the contractor's hands. Torloni, or Torlonia as he was now called, thought himself justified in using temporarily for his own purposes the money that had thus strangely come into his possession, provided that he should in the end restore it, as he subsequently did, to the representatives of the Republic, and opening a bank he was able to conduct operations of considerable magnitude.—*Time.*

How to cool a Cellar. — A great mistake is sometimes made in ventilating cellars and milk-houses. The object of ventilation is to keep the cellars cool and dry, but this object often fails of being accomplished by a common mistake, and instead the cellar is made both warm and damp. A cool place should never be ventilated, unless the air admitted is cooler than the air within, or is at least as cool as that, or a very little warmer. The warmer the air the more moisture it holds in suspension. Necessarily, the cooler the air, the more this moisture is condensed and precipitated. When a cool cellar is aired on a warm day the entering air being in motion appears cool, but as it fills the cellar the cooler air with which it becomes mixed chills it, the moisture is condensed, and dew is deposited on the cold walls, and may often be seen running down them in streams. Then the cellar is damp and soon becomes mouldy. To avoid this the windows should only be opened at night, and late — the last thing before retiring. There is no need to fear that the night air is unhealthful — it is as pure as the air of midday, and is really drier. The cool air enters the apartment during the night, and circulates through it. The windows should be closed before sunrise in the morning, and kept closed and shaded through the day. If the air of the cellar is damp it may be thoroughly dried by placing in it a peck of fresh lime in an open box. A peck of lime will absorb about seven pounds, or more than three quarts of water, and in this way a cellar or milk-room may soon be dried, even in the hottest weather. — *Scientific American.*

Steam-pipes and Woodwork. — Concerning the mooted question of the danger of fire from the contact of steam-pipes with woodwork, the engineer of the City of Quebec writes the *Scientific American* as follows: "I am of opinion, from practical experience, that hot-water pipes in contact with woodwork are dangerous, and I only wonder that insurance companies do not refuse to insure where the necessary precautions are not taken to isolate pipes sufficiently to prevent danger, which, as I shall presently show, it is easy to do. During soft weather steam and hot-water pipes become very hot from the surrounding air being too warm to relieve them of or abstract their heat as colder air does. On one occasion this winter, a very soft day, my steam-boiler had raised the temperature throughout all the pipes about the house to such a scorching heat that everywhere the woodwork was very hot, and I could not bear my hand on any portion of it without burning it as if I held it on a hot stove. It is only two or three weeks ago that a towel laid across the coil in a room on the third floor of a house was actually scorched as if by a red-hot iron, and this has happened more than once. True, water heated under atmospheric pressure only attains to a heat of 212° Fahrenheit or 100° Centigrade; but in a five-story house, even with an open well or cistern in the garret, above a height, say, of fifty feet — equal to a pressure per square inch of nearly twenty-two pounds — the water, of course, reaches a much higher temperature as it does in any closed vessel; and if to this be added the additional pressure or resistance in the rising mains due to the retarding by friction through long stretches of pipe with numerous right-angled bends, it is easy to understand how the temperature required to force the column of water along may be increased so as to become exceedingly dangerous."

The Matapalo or "Tree-killer." — One of the forest curiosities of the Isthmus of Darien and lower Central America is the matapalo or "tree-killer." This starts in life as a climber upon the trunks of large forest trees, and, owing to its marvellously rapid growth, soon reaches the lower branches. It then begins to throw out many shoots, which entwine themselves all around the trunk and branches, and also aerial tendrils which, as soon as they reach the ground, take root. In a few years this gigantic parasite will completely envelop the trunk of the tree which has upheld it and kill it. The whole of the inner dead tree will then rot away, leaving the hollow matapalo standing alone and flourishing.— *Exchange.*

Fireproof Solutions. — Sir F. Abel, F.R.S., invented a silicate of soda which, when applied to wood in the form of a thick syrup, gives considerable resistance to fire. The silicate forms a hard coating, and can be used as follows: The treatment is by painting the wood, first, with a dilute solution of silicate of soda, secondly, with a lime-wash of slaked fat lime colored with mineral ochres or blacks, and, lastly, with a stronger solution of the silicate. The surface of wood should be moderately smooth, and any covering of paper, paint, etc., be removed. A solution of the silicate in the proportion of 1 part by measure of the syrup to 4 parts of water is prepared in a tub or earthen vessel by stirring the measured proportion of the silicate first with a small quantity of the necessary water until a complete mixture is produced, and then adding the remainder of the water in successive quantities until a perfect mixture in the requisite proportions is obtained. The wood is then washed over with this liquid by means of an ordinary whitewash brush, the latter being passed three or four times over the surface, so that the wood may absorb as much of the solution as possible. When this coating is nearly dry the wood is painted with the lime-wash. A solution of the silicate, in the proportion of 1 part by measure of the syrup to 2 parts of water, is then made as above described, and a sufficient time having been allowed to elapse for the wood to become moderately dry, this liquid is applied upon the lime in the manner directed for the first coating.— *Building News.*

TRADE SURVEYS

The slight cessation in midsummer building activity will be followed by a resumption on a probably larger scale. Builders in several large cities have said within ten days that they regard the fall prospects as quite encouraging. Many architects have about completed work on large public buildings, which are to be completed during the season. The building fever will not abate a particle this year, and probably very little next year. The two causes underlying this phenomenal activity are the need of more house room and the need of wider channels for the investment of capital. The abundance of capital will probably continue, although it is always possible to frighten it. Several factors enter into this question. Money can be made suddenly scarce, though successful financial combinations, aided by international understandings as to what shall be regarded as international money. The abundance of money is a constant temptation to the creation of speculative opportunities. Should these opportunities multiply, building enterprise would suffer. A second cause at work is the decreasing returns from building investments. Small houses in large cities pay less than a few years ago, but huge business structures for office use pay better because of the larger amount of office-space made available. These buildings have been springing up in Western cities, and architects state that there are more such large structures in hand, or projected, than ever before. Even in the far West and Northwest where city real estate is not very dear, commercial considerations are leading to the erection of numerous high and compact and architecturally beautiful business palaces.

The country stands upon a non-speculative basis. Never before was it clearer of speculative ventures and artificial values. Never before has capital been as willing for investment. The wreckers who profit by disaster and panic are disappoioted at the uniformly favorable returns and indications in all quarters. Vast amounts have been disbursed in the liquidations of mortgage indebtedness, but no doubt new mortgages for as much have been created. Bradstreet's figures gives the valne of buildings, for which permits have been issued for six months in twenty-five cities, at $68,000,000, against $53,000,000 in the first half of 1885. It is safe to say that speculative opportunities have been largely and permanently shut off, and the inference is therefore at hand that legitimate enterprise will not hereafter be hampered and sacrificed. The cause which has been so efficacious in brioging about panics has been largely removed by the accumulations of money, and a more thorough understanding of the laws underlying healthful commercial and industrial conditions.

From the above quoted authority it appears that the cost of building operations projected in eleven cities during the first six months of 1886 were $20,853,000, against $22,068,000 for same time of 1885; then the number of projected buildings in thirteen large cities was, in 1886, 15,093; in 1885, 16,319; in 1884, 26,871; in 1883, 24,864, and in 1882, 19,916. This year's investments in New York city are estimated at $75,000,000 in round numbers. Boston's outlay for new buildings for the current year is estimated approximately at $10,000,000, against $13,331,550 for 1885. In Philadelphia for seven months the number of permits taken out foot up 2,349, against 2,217 for first seven months last year, and the number of operations 5,773, against 5,055. Pittsburgh suffers in a reduction from $2,100,000 last year to $700,000 this year. Cleveland repeats last year's record. Columbus drops her building figures from $550,000 for first six months last year to $325,000 this year. Chicago has invested $1,000,000 less this year, but architects and builders say that this deficit will disappear during the year. The new buildings this year number 1,617; cost, $7,395,200. Detroit swells her expenditures $200,000 Louisville makes a gain from $1,225,000 to $1,900,000, and unprecedented activity is reported. Indianapolis falls twenty per cent behind. Kansas City doubles her last year's figures, and will probably erect 3,500 buildings this year at a cost of $6,000,000, St. Paul and Mineapolis show a marked increase. Baltimore permits increased from 1,485 first half of last year to 2,073 this year. Washington fell off nearly half. Richmond holds its own and will show investments this year amounting to about $2,000,000. Charleston and Nashville exhibit very little difference, and Memphis shows a twenty per cent gain.

The industrial and trade conditions elsewhere continue favorable. This year's pig-iron output will reach $6,000,000 tons and the Bessemer steel-rail production has already exceeded all former records at this date. Skelp-iron and wrought-iron pipe were never in greater demand, and the industry generally is expanding with steadiness and safety. Railroad earnings and traffic as compared to former years are improving, resulting in heavier investments in rolling-stock, motive-power and machinery. Commercial exchanges exhibit a slight decline. There is a strong demand for money throughout the West and the supply is sufficient. Manufacturers are daily increasing their capacity and production under the encouraging advices from agents and correspondents. That this year's production will exceed last year's none can doubt, but owing to cost of labor, increased capacity and sharper competition, margins are generally disappointing. The low cost of money on the other hand and the smaller and fewer losses from bad debts are helping traders and manufacturers to bear existing ills with fortitude and patience.



Edmund Burke, Westminster Hall.
W. Theed, Sculptor, 1858.



Musical Composers. Armstead. Sculptor. From the Podium of the Albert Memorial, Kensington.



C. J. Fox, St. Stephens Hall, Westminster Palace.



"Asia." Foley, Sculptor. Albert Memoriel, Kensington.



Lord Herbert of Lea, Pall Mall.
Foley, Sculptor.



George Canning. Westminster Abbey. Chantry, Sculptor.



"America." Albert Memorial, Kensington.

LONDON STATUES

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CONTENTS

A YEAR ago or more we invited our readers to submit their votes for the best ten specimens of American architecture, hoping that the result would be both amusing and instructive, and we feel that it was fairly so. We now wish to make a similar suggestion, and, as the result may easily be of the greatest practical value, we hope for a much more generous response. It must have been noticed how frequently appeal is made to us to furnish the names of books in the several branches of architectural literature, and it must be patent that our answers must be based almost wholly on our personal familiarity with architectural books, which, like that of any other member of the profession, is limited and imperfect. As a means of providing ourselves and our readers with a ready reference-list of valuable books, we have perceived that no method promised so good results as that which the coöperation of our readers could produce, and we therefore ask our readers to send to us lists of the twenty books that experience has shown them an architect can least easily afford to be without. As no two men are likely to think alike, we imagine that an examination of the ballot will disclose the titles of some three or four hundred books which can be classified before publication, under such headings as: general treatises, dictionaries, histories, separate styles, drawing, general construction, strains, materials, carpentry, ironwork, cements, roofs, plumbing, painting, law, heating, ventilation, sanitation, water-supply, and treatises on separate classes of buildings, and so on. We seem to have here enumerated about twenty classes quite accidentally, and not with the intention that each voter should name a book under each of these heads: on the contrary, it would be preferable that any one who has made a special study of any branch should compile his list mainly from the books that bear on his specialty. We dc not mean, moreover, to limit the list to twenty numbers only. The list should be written on one side of the paper only, and should state: (1) the selling title of the book, (2) the author's name, (3) the name and address of the publisher, (4) the date of publication, (5) if illustrated, whether by plates or cuts in the text, (6) the actual or approximate price. If the voter chooses to express a brief opinion of the value of the work, so much the better. As this compilation, if successful, will have a practical value to every one, which cannot be said of the lists of favorite poets, novelists, or historians, or the lists of select reading for the young, which have now and then been published in other journals, we hope that our readers will give to its preparation the time and thought it demands.

THE twentieth convention of the National Board of Fire Underwriters, held a few weeks since in New York, was unquestionably an important meeting, and the address of Mr. D. A. Heald, Vice-President of the Home Insurance Company, a very able and exhaustive exhibition of the present status of the insurance interests of the country; but though it bristles with facts, figures and tables, it would take the instinct of an actuary to get from them, without the closest study, the meat which they contain. The discussions were more of private than public interest, as the feeling seemed to be that it had become a matter of vital interest to examine the present methods of insurance, to discover whether it were possible for any companies to survive under the now common practices, high commissions, cut rates and extravagant expenditure. The important point of the meeting was the adoption of a fixed scale of commissions for agents and brokers, lower by some points, we believe, than the average of recent years. The interest that underwriters have in the constructive methods employed by architects and builders seems to have been wholly neglected, and the only thing we notice bearing on the matter in Mr. Heald's address is the remark, apropos of the ratio of burning, that "rates have little, if any, influence on the ratio of burning." As a statement of past facts, this may be accepted as true, but as to potential facts, we believe it very wide of the mark. We have so often expressed our belief that the underwriters had it entirely in their own hands to materially reduce the annual fire-loss, that it is needless to go over the ground again. We trust, however, that before long they will find a way of employing their organized efforts in encouraging better building. If the companies forming the National Board will really work together, and stick to the letter of their compacts, as they now seem disposed to do, we believe they could safely venture on so drastic a measure as to decline absolutely to write risks on new buildings, begun after the adoption of the measure, which did not fulfil certain minimum conditions of safe building, and the grade and character of the requirements could be raised from time to time, the movement being encouraged by a further discrimination in rates. It seems to us that an organized capital of seventy-eight and a half million dollars, which now pays nine and one-half per cent to the stockholders who own it, may safely undertake such a step as this, and that the stockholders would be willing to sacrifice five or ten per cent of their dividends for the sake of having a more reasonable assurance that the remainder could be safely counted upon as a regular and permanent income.

ON the whole we are glad we do not live in New York, life is getting too complicated and upheavals, physical, social and political are more frequent than our Puritan blood could endure. The physical disturbances are those which most often interest us, and we trust our readers will bear with us while we recount how once more the streets of the metropolis are found to contain buried millions for which like true miners the operators have to drift and tunnel till they strike the "pocket" where the metal lies, deep in the trousers' leg of each tax-payer. The newest corporation which has secured for itself the right to inconvenience its fellow citizens for its own certain and their possible benefit by tearing up the road-beds is the Standard Gas-light Company, which proposes to furnish the city and its citizens with illimitable cheap water-gas. Apart from the fact that water-gas is generally supposed to be only less dangerous than the natural-gas which is now used with more or less safety in some parts of the Middle States, and hence that the new enterprise will introduce an added zest to daily or nightly life, the scheme of operations of the new company is interesting and highly commendable in that it first sets the example of coöperating with another occupant of the sub-pavement region in such a way that the public will be annoyed by the execution of one compound in place of two individual operations. The gas company has affiliated itself in a certain degree with the New York Steam Company, and for laying its pipes will make use of the same trench which the steam company is obliged to dig, the steam-pipes being laid six feet below grade, while the gas-pipes can be placed only three feet from the surface; so that whenever the steam company extends its lines, the gas company will probably extend in the same direction, and thus will be less of a nuisance to the public than other enjoyers of similar privileges. In a still more ingenious way the gas company will take an economical advantage of the existence of the steam company and its plant. In the manufacture of water-gas the hydrogen needed, to the amount of seventy per cent of the entire mixture, is obtained from steam, and perceiving that at

night when factories and private houses have no or small use for the steam which the steam company can, and to a certain extent does supply, since the pressure in the steam mains has to be kept up, the gas company proposes to manufacture its gas at night when the steam plant would otherwise be idle. In this way the steam company becomes interested in the success of the new enterprise, as it is thus assured of an income for the hours when its plant is now idle. The two companies therefore seem likely to work most harmoniously together, and have already bought, at an outlay of a million-and-a-half dollars, six sites at intervals of a mile on the river front, where will be erected steam-generating and gas-manufacturing plants, gasometers and so on. Realizing that in water-gas it has a subtle substance of somewhat undefined characteristics to deal with, the Standard Gas-light Company proposes to use wrought-iron pipes for distribution such as are now successfully employed for natural-gas, and contracts for two hundred and fifty miles of these pipes are, it is said, soon to be placed.

AN international exhibition of a restricted but not the less interesting character will be held in the Kunstlerhaus, at Vienna, during December and January next, under the auspices of La Société des Arts Graphiques. The objects admissable for exhibition are such engravings, etchings, woodcuts, lithographs and any form of illustration produced by any of the innumerable chemical processes as have been produced in any part of the world since the exhibition of 1883. Illustrated publications will also be admitted, and though not so stated we presume that the processes of chemical reproduction will be shown in operation, as well as the perfected results. Contributions from all quarters are solicited, and must be sent before the end of September to the bureau of the Society, VI, Magdalenstrasse, 26. Contributors are requested to forward their plates unmounted, the Society charging itself with the cost of framing and hanging. The jury of admission will consist of three members of the Society and four members of the Kunstlergenossenschaft, or Society of Artists, who will also award the medals and honorable mentions. The Society reserves the privilege of publishing in its annual, the *Jahrbuch der graphischen Künste*, which will serve also as the catalogue of the exhibition, such plates or portions of plates as may seem advisable, the method of reproduction being arranged with the author of the plate. Further publication will also be made, together with critical reviews of the exhibits, in *Die graphischen Künste*, the organ of the Society. This is, we believe, the first of a series of annual exhibitions of this kind which are to be held at the same place about Christmas time each year.

TURNING over some old papers the other day, we came upon two or three bills for carpenter-work and plastering, dating back to 1821 and 1822, which have a certain interest, as showing the value of work and materials at that time, compared with the prices now current. One thing which surprised us, and will, perhaps, be equally surprising to our readers, is that the cost of lumber, keeping in view the comparative purchasing power of money, was at that time far greater than it is now. Sixty-five years ago a large part of the United States, which is now cleared, was an unbroken forest, and every township in the Eastern States must have contained a good deal of timber of the original growth, yet we find "refuse boards" charged in 1821 at eleven dollars a thousand feet, which would be a high price now, while painters' work, which is the only labor we find charged in the bills just now before us, is put down on the bill, which would naturally include profit, at seven shillings and sixpence, or one dollar and a quarter per day. The inference is that it would have taken a painter or carpenter in those good old days at least twice as long to earn money enough to pay for boards to cover his house as it does now, notwithstanding the fact that the timber is brought ten times farther to market now than it was then, and that the supply is, according to all accounts, nearly exhausted. Among the other items we find laths charged at seven shillings, or a dollar and seventeen cents per thousand, and clapboards at "twenty-five cents for ten," or twenty-five dollars per thousand. This would be a low price for pine clapboards now in Massachusetts, but it was a high price then compared with the value of labor. Contrary to the general impression, spruce and hemlock seem to have been very generally used, and we find items of hemlock boards at eleven dollars a thousand feet, and spruce at fourteen or fifteen. Clear pine plank, which many people imagine to be a much scarcer material now than in the days when second-growth timber was unknown, is charged in the bills at fifty dollars a thousand feet, which would be a tolerably high price in the same locality to-day, and corresponded then to about twice the value, in the form of labor and cost of living, that it could be exchanged for now. Of some materials, the cost seems to have been even greater then than at the present. In a bill for painters' work, dated 1827, we find oil charged at twenty-three cents a quart, which even allowing for profit, is a higher price than most architects would now approve in a days'-work bill, and varnish is put down at the rate of four dollars a gallon, a charge which would just about pass an architect's criticism in these days. One of the items is for "green paint for chairs," so that if any of our readers are of an archæological turn of mind, they may make a note here that the fashion of covering furniture with this ugly and adhesive coating, which has not died out even in our own college days, dates back at least fifty-nine years. The credits on this bill, which amount to about seventy dollars, include items of thirty-five bushels of potatoes at thirty cents a bushel, and two barrels of cider, differing apparently either in size or quality, as one is credited at two dollars, and the other at eight shillings, Massachusetts currency, or one dollar and thirty-three cents.

ALTHOUGH the responsibility of building contractors with us is not so great or so rigidly defined as it is in France, it seems possible that a claim might be brought against an employer who had detailed a workman to do a certain job under the direction of the owner, who might afterward seek to recover damages on the failure of the work, although the contractor had never visited the job, and had given no advice or order relating to it. A French gentleman wrote to a contractor to send him a workman to build a hot-house, the workman to do the work as the owner should direct. The contractor provided the workman, and also a certain quantity of cement which was used in building the walls of the hot-house, the owner supplying the other materials. As these walls, built under the owner's orders, were too thin, they fell down before the building was completed, and had to be rebuilt more stoutly. After a while, the contractor sent in his bill for the wages of the workman and the quantity of cement supplied. The owner offered to divide with the contractor the cost of the rebuilding made necessary by the accident. The contractor declined this offer and brought suit for the full amount, but lost it and was condemned, moreover, to recompense the owner for the damage the accident inflicted on his plants. In spite of this, *La Semaine des Constructeurs* holds that the contractor's responsibility exists only when he has the right to give orders to his workman, and actually watches or has the right to watch over the manner in which the work is done. It seems to us, however, that if the workman was really in the employ of the owner, the contractor made a mistake in sending in his bill for anything more than the cement he supplied for the job. If contractors are to be held accountable in such cases, it seems that the only way they can relieve themselves from risk is to remove the detailed workman from their pay-rolls during the job and re-engage him on its expiration.

A NEW method of protecting iron with magnetic oxide, the invention of M. de Meriteus, is briefly described in *Engineering*, which expresses the opinion that if the method works as successfully in practice as it does in the laboratory it will probably supersede the Bower-Barff process, as it is so much simpler in manipulation. In a bath of distilled water heated to 156° to 176° Fahrenheit, the metal to be coated is placed, and an electric current passed through it, the current having only sufficient electro-motive force to decompose the water. The oxygen when liberated collects on the metal, and in a few minutes the darkening of the surface shows that the union of the gas and metal has taken place, and that magnetic oxide, $F^5 O^4$, has been formed; in an hour or two the coating of magnetic oxide will resist a scratch brush and will take a fine polish. Apparently the only thing to avoid is the use of a too strong current, the effect of which is to cause the formation on the metal of a pulverulent oxide which has no resisting power. It seems that with a tank of distilled water, a small dynamo, care and a little experience, metal work may by this process be protected by the ordinary contractor, and practically almost *in situ*.

STUDIES IN THE RENAISSANCE.[1]—IV.

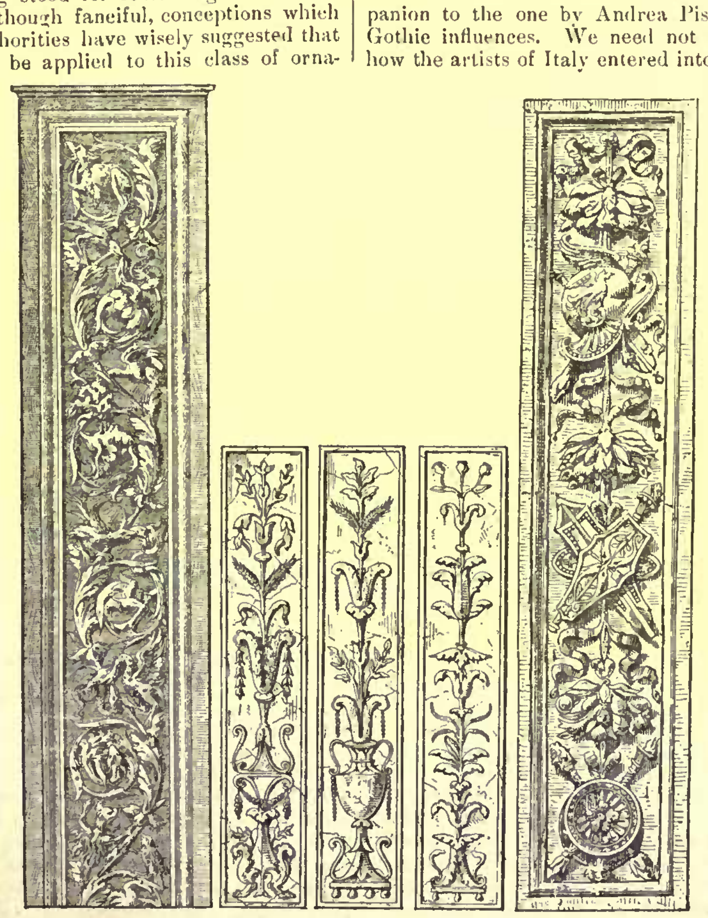
THE ARABESQUE.



Fig. 8.

IN a former number we discussed the origin and beauties of the "arabesque," and we promised to return to that interesting element of the Renaissance before passing on to other details. Thus far we have traced this beautiful form of decoration back to the polychromatic ornament of the Greek *antæ*, and have seen how the Romans filled in the panels of their *antæ* with acanthus scroll-work. It seems clear that the *cinque-cento* ornamentists could not claim to have originated the arabesque, although, as we shall presently find, they may take credit for clothing it with a thousand-and-one fresh and beautiful forms.

Reference has already been made to the unfortunate nomenclature of the arabesque. It might, with much more propriety, have been called the "grotesque," if that word had retained its original meaning, for this class of ornament undoubtedly sprang from the ancient models found in the baths or grottos of old Rome. The word "grotesque" has long stood for something more coarse than the graceful and delicate, although fanciful, conceptions which are called arabesques. Some authorities have wisely suggested that the term "Raphaelesque" should be applied to this class of ornament; for, no doubt, the growth of it is largely due to Raphael's renowned Vatican designs. The name has not, however, been received with favor, and the misnomer "arabesque" must still hold good. Before studying it in the charm of its full *cinque-cento* bloom, we may profitably look at its development in the *tre-cento* and *quattro-cento* periods, for it must not be supposed that the beautiful conceptions of the sixteenth century sprang into life in a generation. The way was paved for that wonderful epoch by the men of centuries before. So soon as the early part of the thirteenth century, Nicolo Pisano, an enthusiastic and able reviver of antique sculpture, made a stand for a return to the style of the Classics. Other great men — who are now remembered only, or principally, as *literati* — spent years of labor in the same cause. Those sworn friends, Petrarch and Boccacio, really spent more time in the preservation and restoration of old Roman and Grecian literature than they did in writing the prose and poetry which has made them famous. Cosmo, the father of the Medici, was surrounded by a noble band of learned men, who labored hard for a revival of Classical learning, and but for their pioneering efforts in this direction, it is hardly likely that a revival of the Classic in architecture and ornament would have followed. The establishment of the printing-press and the wondrous wood-cuts which, ere long, made their appearance in the earlier books, did much to help forward the revival, especially the development of the arabesque. Andrea Mantegna's illustrations to "*Hypnerotomachia, or the Dream of Poliphilus*," published about 1490, afford a noble example of how the printers first commenced to distribute ornaments which were founded upon old Greek and Roman forms.



Figs. 9, 10, 11, 12 and 13.

The publication of the works of Vitruvius, about the same time, gave a great impetus to art in a like direction; but generations before this there is evidence that the Italians never took kindly to the prevailing Gothic forms. In the ceilings of the Church of Assisi, ascribed to "the father of painting," Cimabue, we find the acanthus beautifully drawn, a fact which shows that the loveliest of decorative conceptions renewed vitality at that early date. This was, however, but the budding of the new style; the blossom did not appear until the beginning of the fifteenth century. Prior to this it was more a revival of principles; presently it became a literal renaissance, and carried all before it. In considering the works which are associated with this transition period, one cannot help admiring the freshness of those early efforts which show a desire to return to the æsthetic principle. Indeed, it is questionable whether the combinations of Classic with the prevailing Christian elements, which we find in the beginnings of the epoch, are not less stilted and more admirable than the later very correct but painfully academical copies of the antique. The pioneers worked with a *chic* and *naïveté* that were, to a great extent, curtailed a few centuries later. In the Renaissance, particularly in the arabesque, recourse was had to all sorts of fruit and flowers, and it is interesting to note the earliest example of this adoption of purely natural forms, simply *for the sake of their beauty* and apart from symbolism. It is to be found in the Cathedral at Lucca, in the celebrated monument to Ilaria di Caretto, erected in 1413 by Jacopo della Quercia. A good cast of this remarkable work may be seen at the Crystal Palace, and those of our students who are within reach of the excellent Renaissance court which is to be seen there, will do well to visit it. The chubby boys, or *puttini*, supporting festoons of flowers, were, at the date of their production, a startling innovation on current traditions. The fountain in the Market Square, Siena, by the same sculptor, was another step in the Renaissance direction, and secured for Jacopo the sobriquet of "Jacopo della Forte." But, tempting as the general history of this period always is, we must direct our attention to the growth of the particular piece of ornament — the arabesque — which is now under consideration, and we find a suggestive lesson in its development on the renowned bronze gates of the Baptistery at Florence.

The fifteenth century had no sooner dawned than the art circles of Florence decided to raise another gate to the Baptistery, as a companion to the one by Andrea Pisano, which was designed under Gothic influences. We need not here recount, at length, the story how the artists of Italy entered into the competition, and that three, Brunelleschi, Donatello and Lorenzo Ghiberti, were credited as being "worthy." Somehow or another, the two former retired from the competition—it is said, voluntarily—and young Ghiberti, then only twenty-two years of age, set about his gates. It took twenty-three years of honest labor before Lorenzo had the joy of seeing the first part of his task finished, but when it was erected it took every one in grand old Florence by storm, and the authorities, as evidence of their satisfaction, gave Ghiberti an order for another gate, a work which he finished about the year 1444. It would be difficult to overpraise the beauty of this supreme effort of the early Renaissance, or the effect which it had upon the propagation of the new style. Fortunately, most of our museums now possess replicas of Ghiberti's work, and it is delightful to study such excellent casts; but to see the gates themselves is a rare and impressive pleasure—at least we found it so when making our notes from the originals in Florence. They have so often been copied and illustrated in various books, that we need not give fresh engravings of them here. We have, moreover, only to deal with one portion of them just now; viz., that which concerns the history of the arabesque—and it is the band of ornament surrounding the panels, rather than the Scriptural subjects of the panels themselves, that is calculated to serve our present purpose. The piece of the banding which is shown in our initial cut will sufficiently indicate the character of all the rest. Therein, Ghiberti has tied together, with consummate skill, a collection of leaves, flowers, fruit, vegetables and birds, cut in alto-relievo, of which the section here illustrated gives a fair sample. When it is remembered how early in the history of the Renaissance — before the second half of the fifteenth century—this effort was put forth, the talent and courage of the young sculptor become amazing. No wonder that such artlights as Buonarotti and Raphael revered the name and works of their gifted predecessor, Ghiberti. Anon, we shall have to talk of some contemporaries of Ghiberti — notably, Lucca della Robbia and Filippo Brunelleschi — but for the present it is enough to show the

[1] Continued from Vol. XIX., No. 538, page 154.

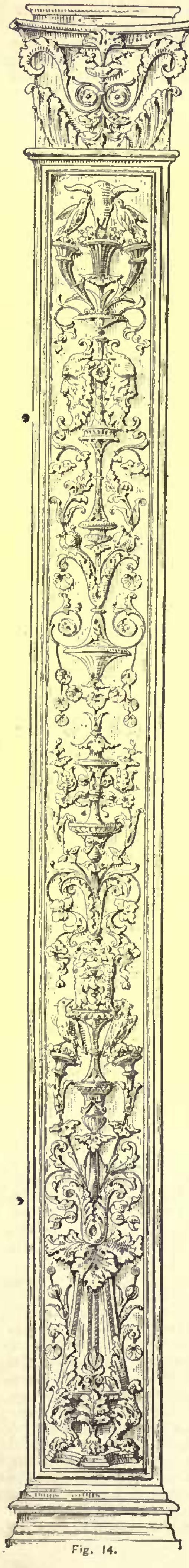


Fig. 14.

first blossoming of the arabesque in a naturalistic direction. While nature is, perhaps, too faithfully copied in these forms, there is an arrangement and banding together of the parts that makes the bordering truly decorative. We may here—just by way of showing that one, at least, of the contemporaries of Ghiberti used fruit and flowers in much the same way as he — draw attention to a beautiful medallion by Lucca della Robbia, which we saw in Florence. It is but inadequately illustrated in Figure 15, but a glance at the banding will show that the treatment of the fruit is much like that which is found on the Baptistery gates. Here, again, the forms are merely employed, together with the Classic dentil, on account of their beautiful line and shadow-giving properties. This bit of Robbia is, however, only introduced by the way. His work is a study by itself, and must be considered as such. The marked difference between this *quattro-cento* treatment and that which preceded it, was that nature not only supplied mere suggestions, but was drawn upon for exact models of anything and everything that had decorative properties about them. The typical element was eliminated, except in some general way—such as *puttini* and flowers to a fountain — and the purely decorative substituted. In designing, the artists disposed their materials simply with a view to the picturesque and ornamental. Here, then, we get the first indications of a definite return to an æsthetic *motif*. Ghiberti employed these flowers and fruit because they made a beautiful border to his gates, full of light and shade, not desiring to convey any other lesson by their use than that of simple beauty. By this innovation the traditions of, say, a thousand years were broken, and art was liberated from the trammels of mystic symbolism. From this time *meaning* ornament practically succumbed in Italy, and has never to this day recovered its once proud position. We have dwelt rather long upon this stage in the development of the arabesque, for, while the origin of it in the Classic has been carefully shown, the branching out of its details in this new direction must be none the less carefully observed. Noting even this fragment, we can see how the door was opened for the admission of all sorts of comparatively new elements; and we should gather from this the useful lesson that any designer, in any age, can re-dress the Renaissance with such forms as are near him, without transgressing the canons of the *quattro-cento*, if not of the *cinque-cento*. How various Italian artists have, from time to time, clothed afresh the arabesque, will be made clearer by observing the rest of the annexed illustrations. Before considering them *seriatim*, we may remark that cartouches or scrolled shield-work figure largely in that Italian Renaissance which preceded the purified *cinque-cento*. Of those forms we must, however, speak later on. The *quattro-cento* was also distinguished for the first introduction of that remarkable style of arabesque — all too-florid — which culminated in Raphael's celebrated decorations in the *loggie* of the Vatican.

If asked for a definition of the elements which were used in designing at this pre-*cinque-cento* period, we should describe them thus: Classical ornaments used with conventional and natural flowers and foliage—the former oft-times bearing a strong resemblance to the Saracenic; men, women and animals, natural and grotesque; cartouches or pierced and scrolled shields in great prominence; tracery, independent and developed from the scrolls of the cartouches; and all sorts of jewel forms. Description is, however, of but little use to make clear the unparallelled variety of the elements of this richly-dressed style. These engravings will help our definitions considerably. Figures 14 and 16 have been sketched from a couple of beautiful Italian pilasters which are now in South Kensington. Figure 14 is from an Italian fountain, in Florentine blackstone (*pietra serena*) which formerly stood in a house at Florence. It is attributed to Benedetto de Mariano, date about 1490, and is a beautiful example showing how the arabesque was progressing at that period. Its details do not, however, depart largely from the Classic. Birds, masks, and a few shells, together with acanthus scroll-work, are the only elements in its composition. In the accompanying pilaster, Figure 16, greater freedom is shown, and it is on that account a more characteristic example. Towards the lower portion, musical instruments and even gardening implements, are strung with admirable skill from the central stem. The Classic element is strongly marked in both these designs, and the three simple pilasters, Figures 10, 11 and 12, are examples of the same class. We must dive farther into the history of the arabesque, in order to discover greater freedom, and Figures 9 and 13 herewith

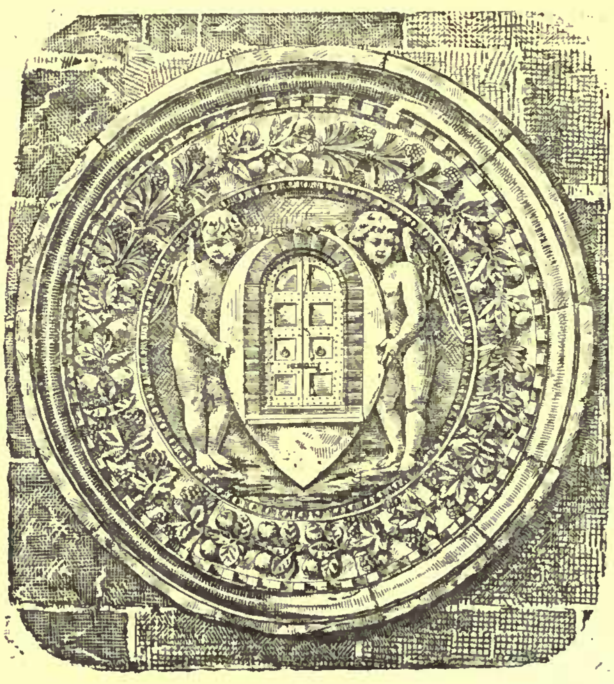


Fig. 15.



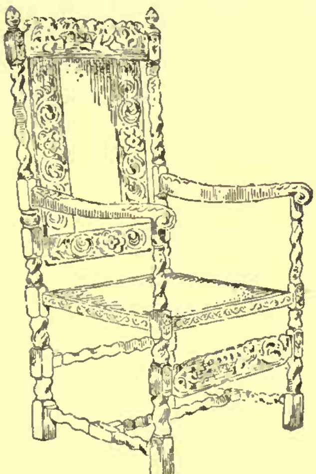
Fig. 16.

show two entirely different forms. In Figure 9 we get nothing but scroll-work running off into all sorts of queer birds and chimerical creatures, a design full of rare spirit and skill. No purely Classic pilaster ever contained half the wriggling, racy spirit which can be discovered in this fragment. In Figure 13, the panoply of a Roman warrior is separated, and, together with a few bunches of fruit, is made up into a charming arabesque. While the elements of this forcible design are purely Classic, the clever arrangement comes of the Renaissance, and, taken altogether, it shows that nothing which has graceful shape need be placed outside the scope of this most comprehensive of styles. In this case, moreover, all the details are strung from the top of the panel instead of springing from a stem, as is usually the case. There is no reason why the uniform of an ordinary nineteenth-century policeman or soldier should not be similarly hung up on a nail in a modern panel.

J. WILLIAMS BENN.

AN EDITOR'S TRIP ABROAD.[1]— VIII.

THE ARLBERG TUNNEL.—INNSBRUCK.—MAXIMILIAN'S TOMB.



OLD CHAIR. WOODSOME HALL. YORKS. ENG.
AFTER SKETCH BY WRILEY
A A SKETCH BOOK. LONDON.

THOSE persons who dislike diligence riding, or who. for any reason, wish to take the most interesting railway route possible into or out of Switzerland, should certainly try the Arlberg line, either to or from Innsbrück, through the new tunnel. The train leaves Zurich, the prettiest and pleasantest city in Switzerland, at the very comfortable hour of five minutes before ten, and runs straight up beside the lake toward the Alps, which form the background of the Zurich landscape. The track runs almost in the water of the lake, and the passengers have just about time enough to become thoroughly penetrated with the beauty of the lovely country along both shores before they are suddenly transported into a gorge hemmed-in by tremendous precipices, which conduct them, past a long succession of snowy peaks, and ravines filled with ice, to the meadows of the Upper Rhine valley, the line of division between Switzerland and the Tyrol. After following the Rhine northward for fifteen or twenty miles, the train turns eastward, and plunges into the Tyrolese Alps, working its way upward along the side of the mountains which shut-in the narrow valley of the Ill, until it reaches the great tunnel, which, although not so long as the St. Gothard tunnel, is much higher above the sea. Of the supplementary tunnelling which often forms the prelude to a great work of the kind, there is at the Arlberg very little, so that the view of the approaches from the train is almost uninterrupted. On the east side, particularly, after the cars issue from their sixteen minutes of transit through the earth, into the wild valley through which they descend toward the Danube, the road is entirely open, with the exception of two or three very short tunnels, apparently built up purposely, in order to conduct the avalanches from the upper portions of the mountains safely over the track into the abyss below. A hundred miles more of this sort of engineering brings the train to Innsbrück, after travelling for nine hours, at express speed, constantly in sight of snow-mountains and glaciers; and the tourist has then the choice of proceeding either eastward to Vienna, northward to Munich, or south to Verona, as best suits his plans, or he may, as we did, stay over a day or two for the sake of taking a better look at the little Tyrolese metropolis.

A more unexpected sort of place the average tourist seldom comes across. One gets accustomed, when travelling in Switzerland, to frequent changes in the style and construction of the houses, which differ, almost in every valley, in some way from those in the neighboring valleys, but in Innsbrück all trace of ordinary Swiss or Tyrolese architecture disappears, and we find a sort of small Milan or Genoa, with additions from Munich and Nuremberg, dropped in the middle of an Alpine valley. Surprising as it was to find the stucco classicisms of Italy in the midst of the almost purely wooden constructions of the mountain villages, it seemed to me that much of the Innsbrück work surpassed, in perfection of execution, anything that I saw in Genoa. In the modern buildings, particularly, the cement surface was treated with an ingenuity which gave it a real artistic interest. Most of them, like the palaces which served as their prototypes, had rusticated basements, with two or three stories above, united by pilasters, and with windows dressed, and heavy cornices, with or without an attic above, and much pains seem to have been taken to give variety to the texture. A very successful device, which occurred repeatedly, was to cover the projecting faces of the basement rustications with small stones, an inch or so in diameter, set by hand in the cement while soft. It might be imagined that care would be required to do this well, but the workmen seemed to have learned the secret, and the effect, in contrast with the smooth, monotonous mouldings and pilasters, was extremely good, independent of the piquant flavor which such an honest way of treating the material gave to the appearance of the building. For the other portions of the work it seemed to be thought sufficient to mix the stucco for the plain surfaces with coarse sand, using fine sand for the string-courses, pilasters and other dressings. Some of these were very elaborate; one house, in particular, apparently about two hundred years old, being covered with rococo decoration in cement, so heavy and so deeply undercut, that I could not for some time convince myself that it was not of solid stone. On trying some of the old stucco, I found it very hard and tough, resembling good limestone much more than the sandy, dispirited sort of material which our uncles and aunts used to daub over the outside of their New York and New England houses; and, without being entirely converted to plastered architecture, I am inclined to think that if the work could be done as well with us as it is in Italy and Germany, we should find it a valuable resource in the development of that more solid style of building for which there is certainly now a widespread demand in America.

At Chamonix, where a simple style of stuccoed construction is used for the large hotels, I happened to meet with the architect of one in process of erection, and obtained from him some information which supplemented very well that which I was trying to get from observation of the work going on. The walls of the new hotel, like most of those intended for stucco in all countries, were built of rubble, which in this case was of slate, although limestone is naturally the ordinary material. The stones were small; few of them, with the exception of the granite quoins and window dressings, being a foot long, and the wall, although as well bonded as was possible with such materials, looked to me as if it needed very good mortar to keep it in proper shape. The mortar was, however, very good; quite equal, I thought, to mortar of the same age made with one cask of the best Rosendale cement to two parts lime. It was, in fact, made with hydraulic lime, from some quarry in the neighborhood as I learned, mixed with about its own bulk of paste of fat lime, which is at Chamonix the more expensive material. The hydraulic lime seemed to me to have very feeble qualities of any kind. It was delivered in bulk at the building, in rather small, white lumps, and stored under a shed, but before using was brought out, a barrel or two at once, placed in a pen in the open air, and sprinkled with water enough to wet it thoroughly. This caused it to slake slowly, without heating, into a powder, which was heaped up in a convenient place, ready to be mixed, as wanted, with the fat-lime paste already stored near by, and the proper quantity of sand. All the exterior joints of the wall were laid "slack," the mortar not being allowed to come within an inch or two of either face, in order to give a good key to the subsequent stucco. On my inquiry as to the precise method of completing the plastering, which seemed likely to adhere but feebly to the slate, the architect told me that after the roof was on the building, he should have some mortar mixed very thin, almost like whitewash, and should have the wall treated all over with this, following the thin wash later with one or two coats of the ordinary mortar. This, if done by experienced men and with good materials, would, he was sure, give a permanent coating, and the appearance of the houses in the neighborhood, which were free from scars or stains, certainly justified his confidence.

At Innsbrück, although the cement used in the stucco must be of the finest quality, the method of employing it seems to be the same, and although the climate must be very trying, the result is all that could be desired, so far as cheapness and durability are concerned.

Even in the way of real architectural sensations, Innsbrück has more to offer than I had expected. Coming to the place in a certain sense accidentally, through a change in our plans, I had made no study of the guide-books, supposing that nothing more would be necessary than a ramble through the streets to find out everything in the town that I cared for. In pursuing this programme on the first evening after our arrival, I came across a church door, and, naturally enough, opened it and entered. Although it was nearly dark, I could see that I was in a lofty building, with marble columns supporting the nave arcade, a stone pulpit with marble stairs built into one of the columns, and a stone rood-loft carried on arches spanning the nave and aisles, but I was hardly prepared to observe in addition two long rows of gigantic figures in strange costumes, standing under the nave arches, with their backs to the aisles. A closer examination, followed by a second visit the next morning, showed that the twenty-four giants were statues, some apparently in brass and others in bronze, raised on a continuous plinth, and representing various more or less historical personages, from King Arthur of England down to the Austrian emperors of the sixteenth century, all dressed in armor, or brocade or lace, according to sex and circumstances, after the fashions prevailing in the sixteenth or seventeenth century, and very effectively modelled and finished. In the centre of the nave stood the great tomb of Maximilian, the beautiful sculptures on which are, I suppose, pretty well known to most people, but the novelty of the huge brass figures in ruffles and lace, which stood near, made them more interesting to me than the tomb, or, indeed, than anything else in the church, except, perhaps, the superb wrought-iron work which surrounded the Maximilian monument, formed the chancel screen, and protected nearly all the casual openings about the building. Except the beautiful lock on the door, the ironwork was not extremely delicate, but it was coiled and twisted and interwoven with a variety of design, and a masterly handling of

[1] Continued from page 62, No. 554.

the material, which has certainly been seldom surpassed, and would be even more striking if it were not for the gilding with which here, as in most other places fortunate enough to possess such treasures, the best portions have been "touched up," to the ruin of their proper effect.

ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

GALLERY IN THE GOVERNOR'S WINTER PALACE, ALGIERS.

[Gelatine print issued only with the Imperial and Gelatine editions.]

COMPETITIVE DESIGN FOR A $5,000 HOUSE, SUBMITTED BY "*Adonis.*"

STONE to run across north and part of east side; to be a local sand-stone, rock-faced, left very rough and dressed to a line. Exterior stained. Interior (main rooms) chestnut-filled and stained to imitate oak. To be a small laundry and a servants' closet in basement. Servants' room and a large "play-room" finished off in attic.

MASONRY.	
Preliminary,	$27.00
Excavation,	118.08
Footings,	52.00
Foundations,	244.80
Underpinning,	460.40
Windows,	56.25
Hatchway or area,	9.60
Piers and partitions,	1.80
Chimneys, mantels and grates,	285.00
Lathing and plastering,	242.50
Cellar bottom,	59.00
Drains,	36.78
Cesspool,	28.25
Sodding and grading,	30.00
Total of Masonry,	$1,651.46
CARPENTRY.	
Frame,	$216.25
Frame covering,	284.62
Gable covering,	45 24
Roof	120.52
Cornice	42.47
Cellar hatchway,	18.00
Windows,	542.00
Dormer windows,	54.00
Veranda,	$25.00
Cellar windows,	13.75
Floors,	262.10
Closets and store-room,	7.75
Doors,	287.00
Stairs,	130.00
Wainscoting and base,	54 75
Pantry and butler's pantry,	34.00
Kitchen sink, etc.,	5.00
Tower,	85.75
Tank and wash-trays,	23.00
Bath-room,	12.00
Water-closet in basement,	10.00
Mantels,	151.00
Book-case,	15.00
Wash-stand,	3.00
Cold-air duct,	5.00
Coal-bins and partitions in cellar,	10.00
Miscellaneous,	33.00
Painting,	200.00
Tinning, slating, and galvanized-ironwork,	260.00
Plumbing and gas-fitting,	231.00
Total carpentry,	$3,184.20
Total masonry.	$1,651.46
Builder's profit, at 8%,	387.28
	$5,222.94

COMPETITIVE DESIGN FOR A $5,000 HOUSE, SUBMITTED BY "*Mark Twain.*"

MASONRY.	
Excavation	$ 62.50
Foundations,	329.00
Chimneys, mantels and grates,	336.60
Lathing and plastering,	340.00
Drains,	63.00
Miscellaneous,	137.50
Total of masonry,	$1,268.60
CARPENTRY.	
Frame,	$288.00
Frame covering,	412.00
Roof,	199.00
Cornice,	143.00
Windows,	515.60
Dormer windows and gable windows,	75.00
Veranda,	284.60
Cellar windows,	15.00
Fan-lights and transoms,	16.45
Floors,	304.50
Closets and store-room,	19.10
Doors,	341.90
Stairs,	176.45
Wainscoting and base,	90.50
Pantry and butler's pantry,	36.75
Kitchen sink, etc.,	4 50
Bath-room,	22.50
Water-closet,	9.00
Mantels,	200.00
Book-cases,	20.00
Miscellaneous,	11.50
Painting,	295.00
Tinning, slating and galvanized-ironwork,	32.30
Plumbing and gas-fitting,	209.00
Total of carpentry,	$3 632.15
	1,268.60
	$4,900.75

COMPETITIVE DESIGN FOR A $5,000 HOUSE, SUBMITTED BY "*Peu-à-Peu.*"

COMPETITIVE DESIGN FOR PARK AVE. METHODIST EPISCOPAL CHURCH, PHILADELPHIA, PA. MR. BENJAMIN LINFOOT, ARCHITECT, PHILADELPHIA, PA.

NAVE OF S. MARIA MAGGIORE, ROME.

AMERICAN ARCHITECT COMPETITION FOR HOUSE COSTING $5,000.[1]—V.

"*MULTUM IN PARVO.*"—Novelist not isolated. Plan is simple. Nursery is well arranged. A small porch is not a loggia. Details are simple. Staircase balustrade is rather light. Three balusters to the tread would have better effect. Exterior is bare and uninviting. A square tower in stone is interesting, on account of the variety of surface and color in the stonework, and in the way stonework is laid, and also has dignity and mass, and the advantage of shadow in the deep window reveals; but in wood it is apt to be stiff and hard, and to dwarf the remainder of the house.

The house needs shadow, and also needs one belt-course carried around it. Should say that lowering height of stories, roofing house with one long roof with gable at each end; making tower more nearly octagonal, or else twelve-sided; carrying belt around at eaves lines, and making roof to front porch would make the house much better in design. Rendering rather crude.

"*Adonis.*"—Good first-floor plan except for rounded corner. Novelist isolated. Exterior: A chimney brought down over an archway is never agreeable in design. The north side might be made something of if it were not for the third-story excrescences; but the south is more hopeless. This design happens to be a good one to select to point a moral by. In any building that has a roof that is other than flat, the relative proportions of roof and wall are among the first things to be considered, and if the roof is to have any part in the general effect (as it certainly does in the set of designs sent in for the competition), the simpler it is the better. To make a roof simple, not only necessitates the use of a good liberal length of ridge, but also an equally generous length of the lines of eaves, "*Adonis*" has completely nullified the effect of what in construction is a simple roof by cutting the eaves into all sorts of long and short lengths of various levels. Interior details very good. Dining-room alcove good. Rendering clever throughout.

"*Peu-à-Peu.*"—Plan good. Details few but fairly good. Exterior simple. Has the usual defect of gambrelled houses with short ridges, it looks lumpy. View of it from north would not be good. A narrow strip of the lower pitch of a gambrel brought down and contrasted with straight wall is always unsatisfactory. The house would be much better if it could be made lower, and if the ridge could be lengthened. The curved buttresses at entrance steps are not good. Rendering weak and simple.

"*Nemo.*"—Study should not open from the parlor. Plan otherwise fairly good. Details: The end of the settle is not good. Porch cornice needs a frieze. House needs more eaves. General outlines and proportion simple and good. Rendering, lines are shaky, unskilful and uncertain. Foliage is very bad.

"*Utility.*"—Plan compact and fairly good. Novelist isolated in third story. Passages are narrow; night nursery small. Details fairly good. Design of exterior rather clumsy: with such an expanse of wall more projection of eaves is needed, to give horizontal shadows. Shingled arches are at best unattractive, and compose much better with a long, low house than with a square, high one. Dormer too small. Rendering of everything but perspective hasty, but with knowledge of perspective overworked. Stained-glass design is very bad.

"*Mark Twain.*"—Waste room in hall. Studio unnecessary. No constructive details. Interior details: staircase very bad; mantel clumsy. Exterior design, south side too much cut up. Northeast view good. Outlook too high and thin. Rendering a little labored, but fairly good, excepting landscape. The house cannot be built for the money.

THE LIFE AND WORK OF SIR CHRISTOPHER WREN.[2]—II.



I MUST not pass over Wren's work at Westminster, although it reflects no credit upon him. We can only say, in his defence, that he acted for the best, according to the light of his time, and carried out the instructions laid upon him. It is probable that Westminster Abbey did more for Wren than he for it, for the influence of his study of Gothic work necessitated by his careful surveys of this church and Salisbury Cathedral is evident in much of his subsequent work. With regard to the much, and justly, abused west towers, it is only fair to say that Wren had very little to do with them. He only built the lower portions of them, and they were carried on and finished by Mr. Hawksmoor and two other architects. Wren made a design for a central tower, with lantern and spire, which was fortunately never carried into execution. The survey of Salisbury Cathedral took place before the building of St. Paul's, and it probably influenced the St. Paul's work to some little extent, although Wren would probably not have admitted this himself. It is well known that in St. Paul's the proportion of solids to voids is far less than in other Classic churches of large size and importance, a recommendation which needs no comment.

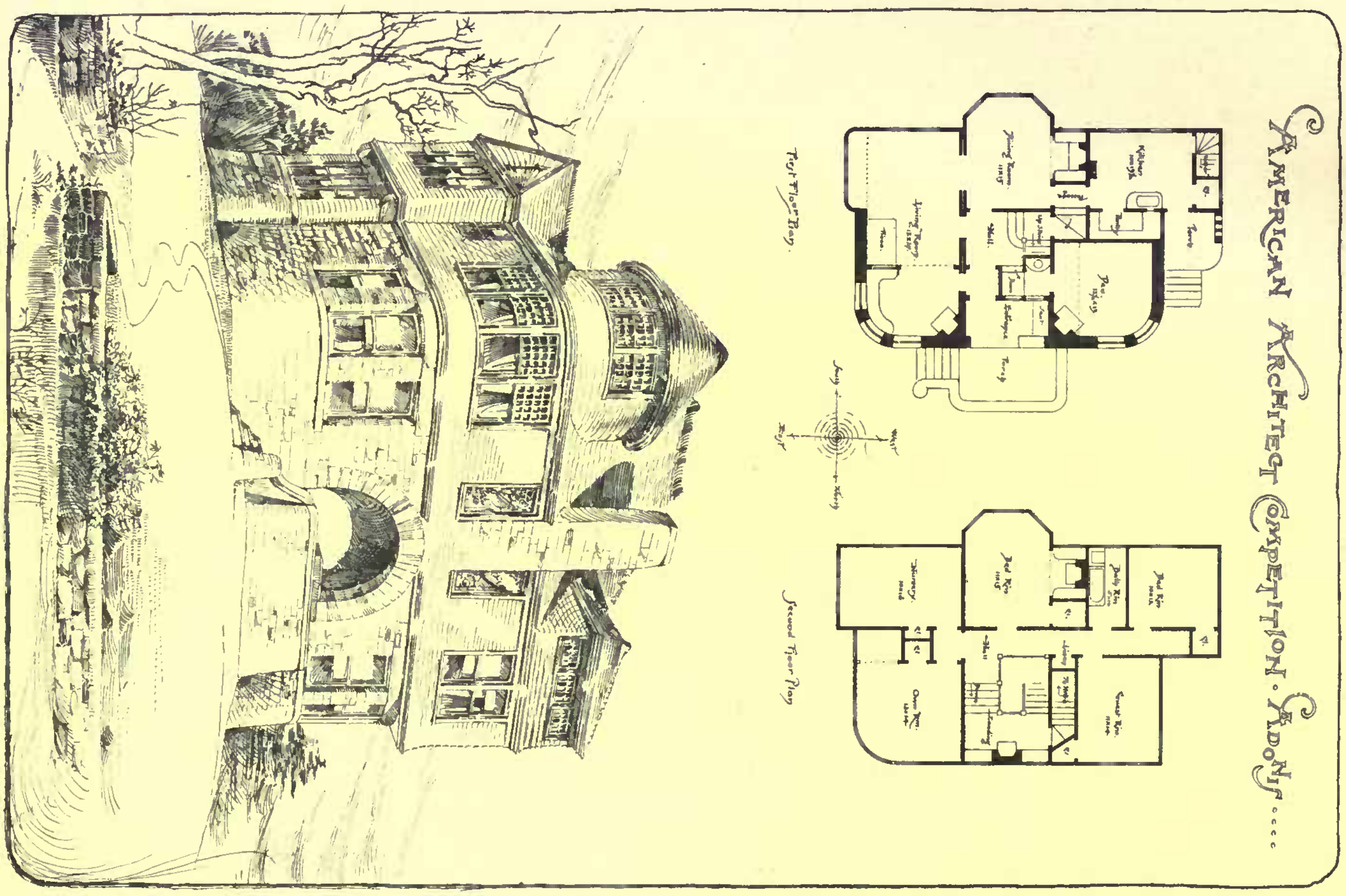
The stonework of Salisbury Cathedral had not suffered nearly so much as that of Westminster Abbey, and so the church escaped Wren's hands with very little injury. Indeed, we have to thank Wren for what little he did do, for I doubt very much if the grand central spire would be remaining at this day if Wren had not made some important structural repairs to it. He found it leaning over considerably and very insecure, but he repaired it so well that it has not moved an inch since. Wren spoke in terms of quite respectful admiration of the character of the work at Salisbury.

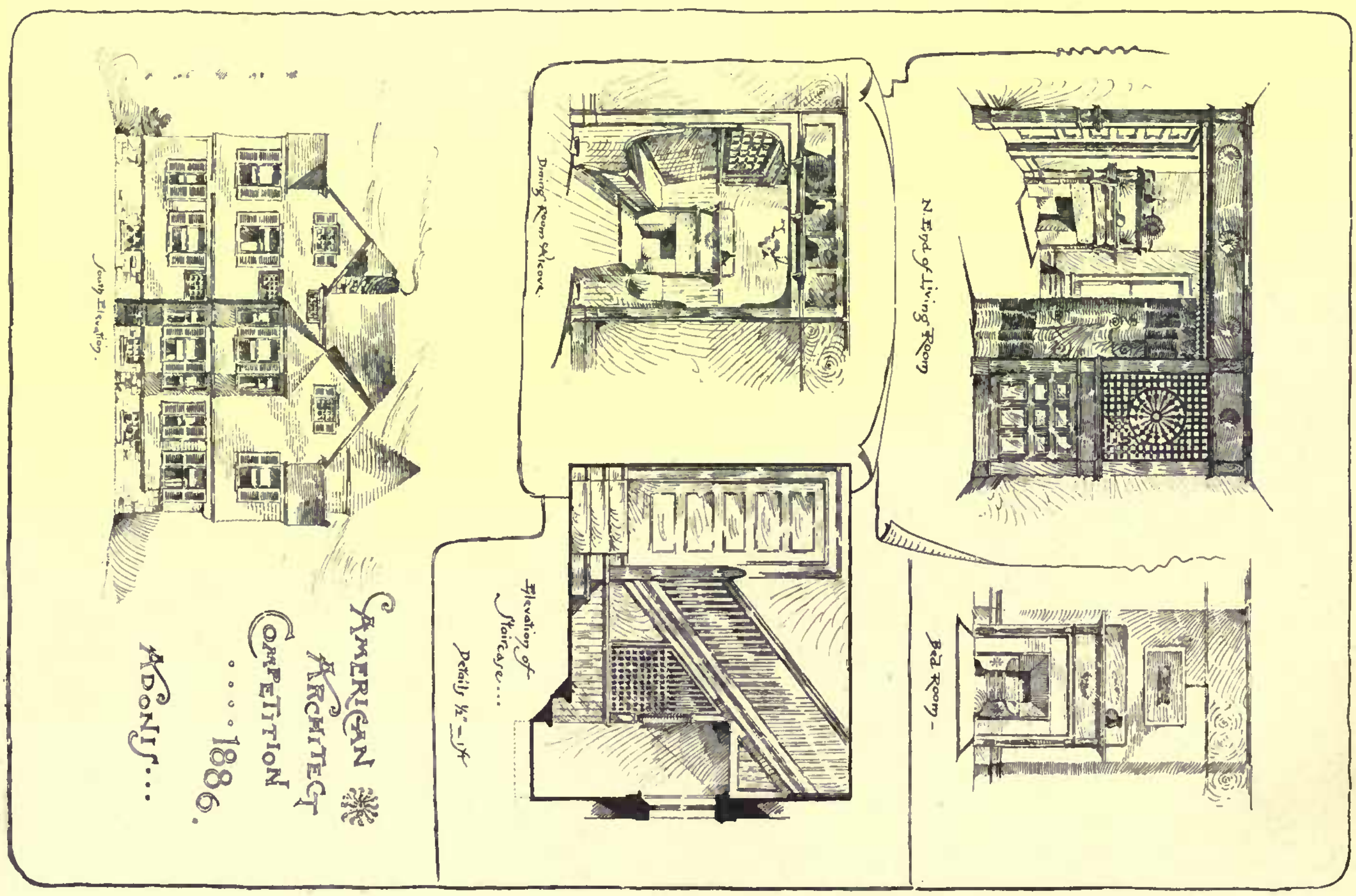
One of the finest schemes Wren ever conceived, and one which unfortunately was never carried out, was his design for the rearrangement of London in rebuilding after the fire. I have made a rough sketch of the plan he proposed, and I think all will agree that a better arrangement for a business city could hardly be made. All the principal approaches to the town—mostly, I believe, the old

[1] Continued from page 62, No. 554.

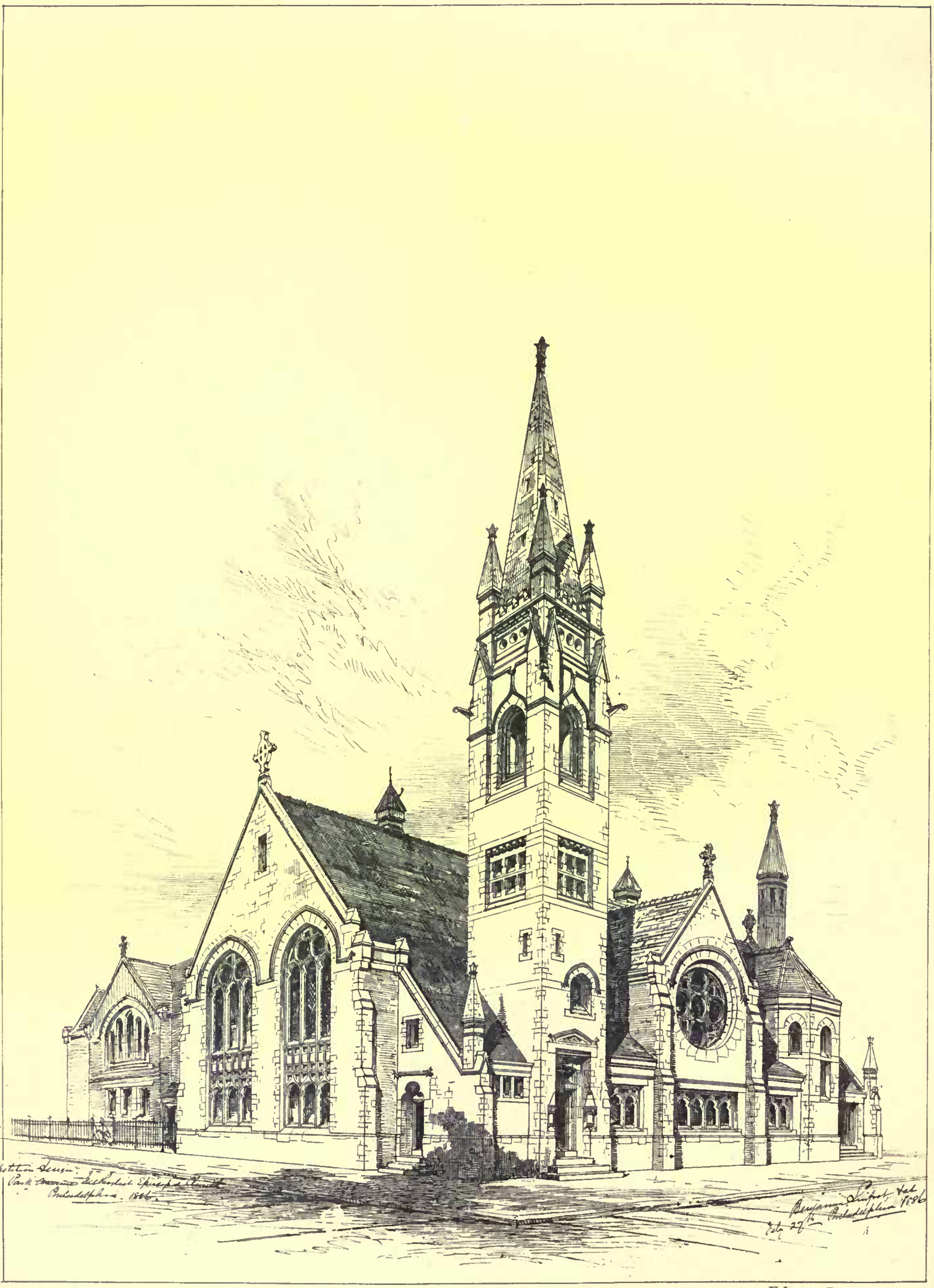
[2] A paper read before the St. George's Art Society by Mr. Arthur Keen. Continued from page 53, No. 553.

No. 555 AMERICAN ARCHITECT AND BUILDING NEWS, AUG. 14·1886.





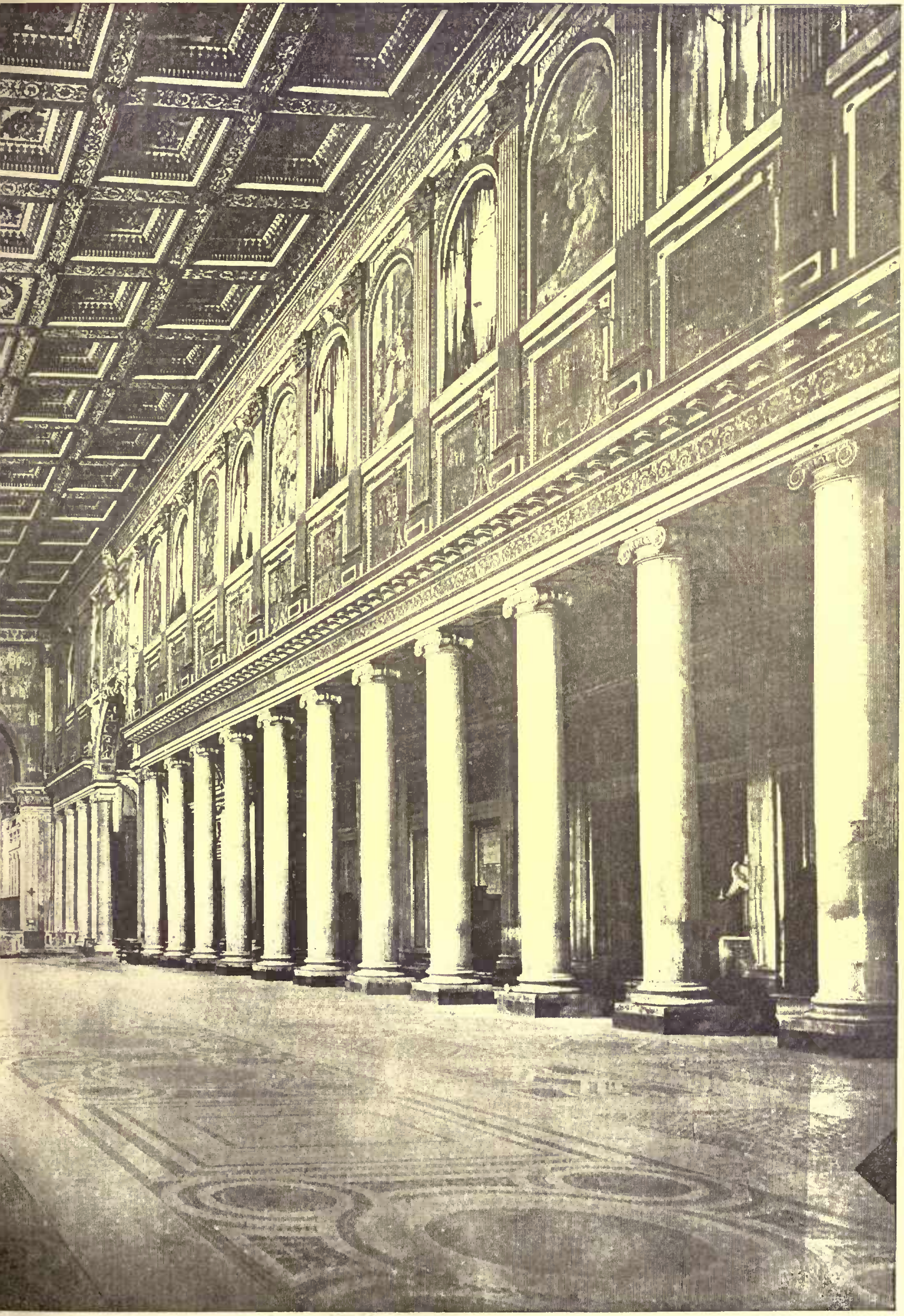
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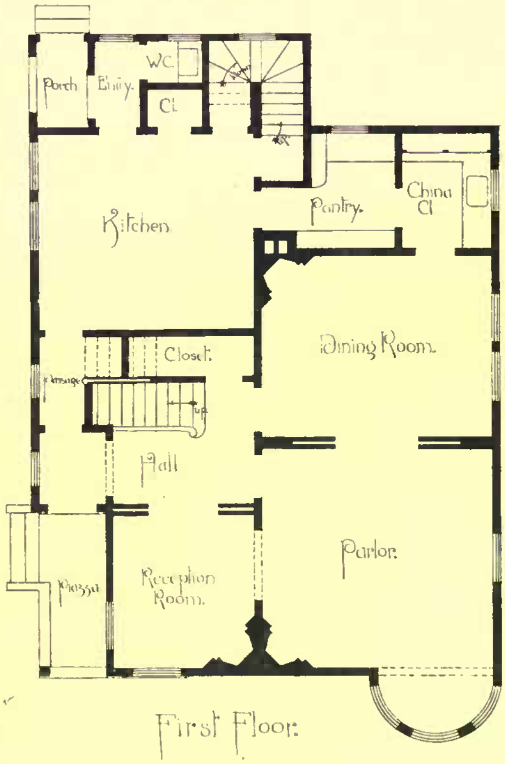
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AMERICAN ARCHITECT AND

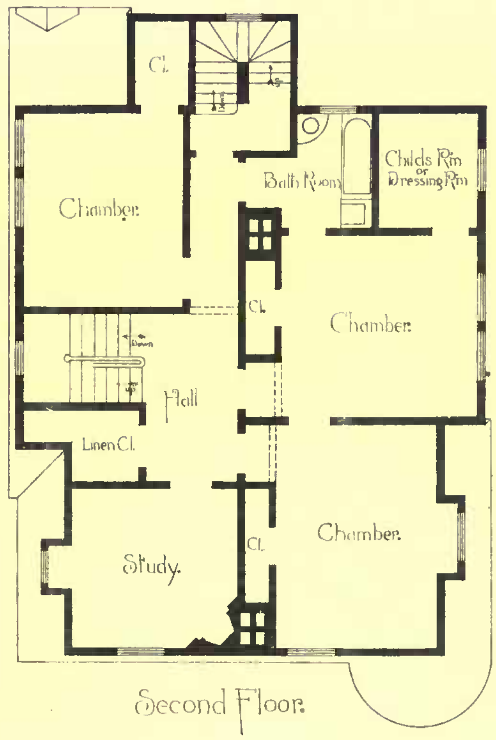




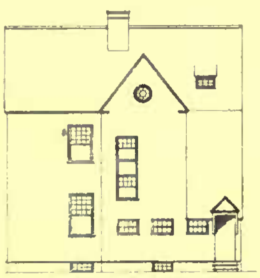
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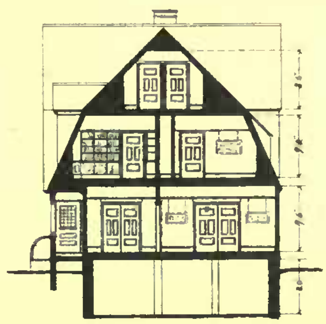


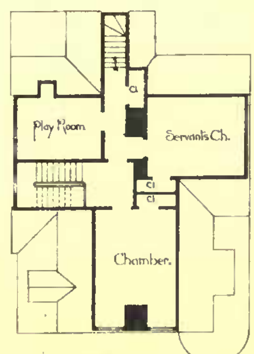
First Floor.



Second Floor.


Rear Elevation


Section.



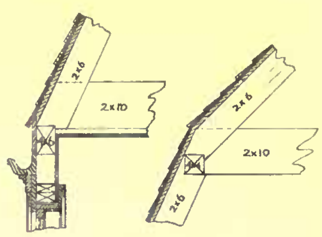
Attic

Scale for First and Second Floors.
" " Rear Elevation Section and Attic
" " Details.

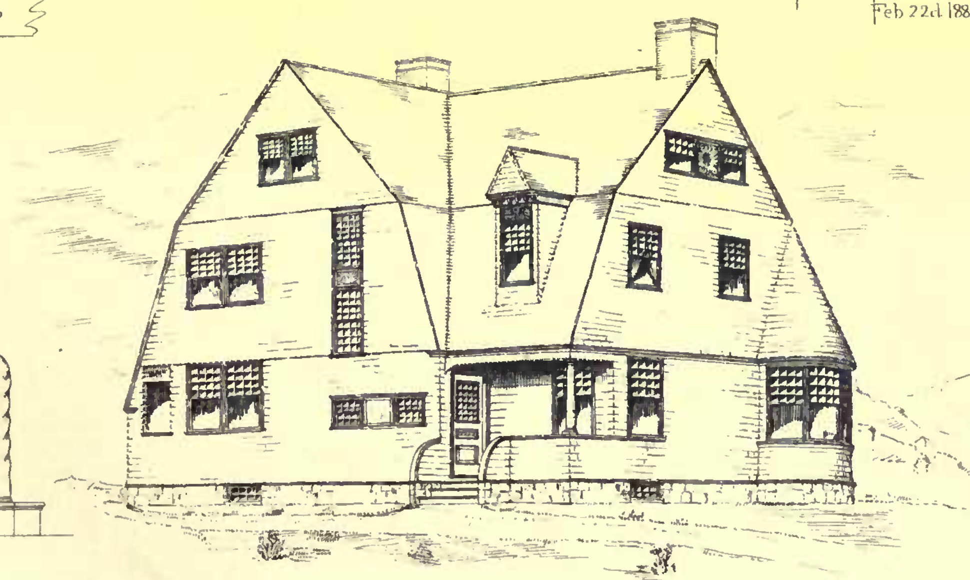
American Architect Competition.

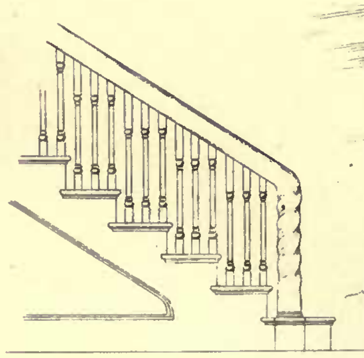
$5000. House for a Novelist.

Peu-à-peu.
Feb 22d. 1886.



Cornice.

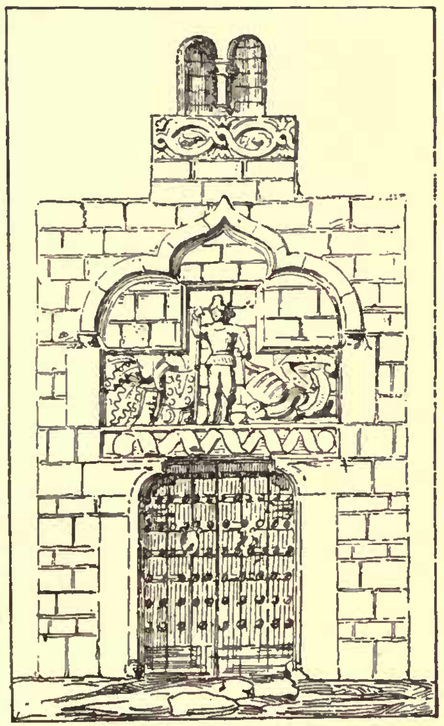

View from South.


Beginning of Stairs.

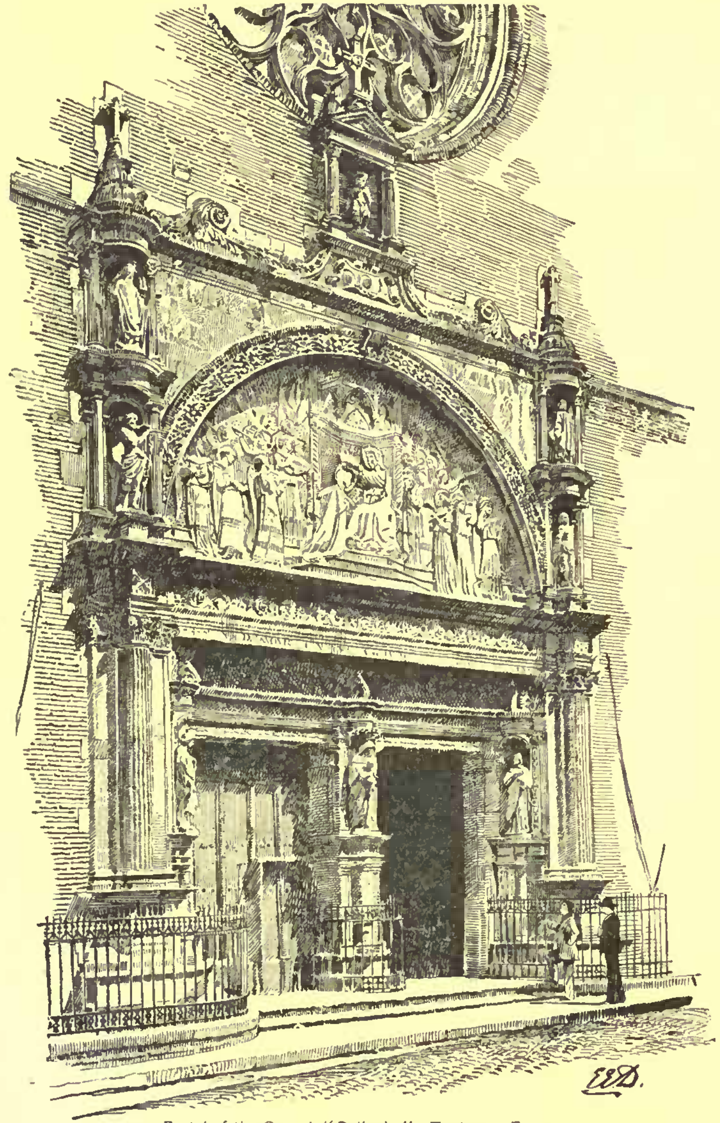
Heliotype Printing Co. Boston.



A Vierlande Farmhouse.



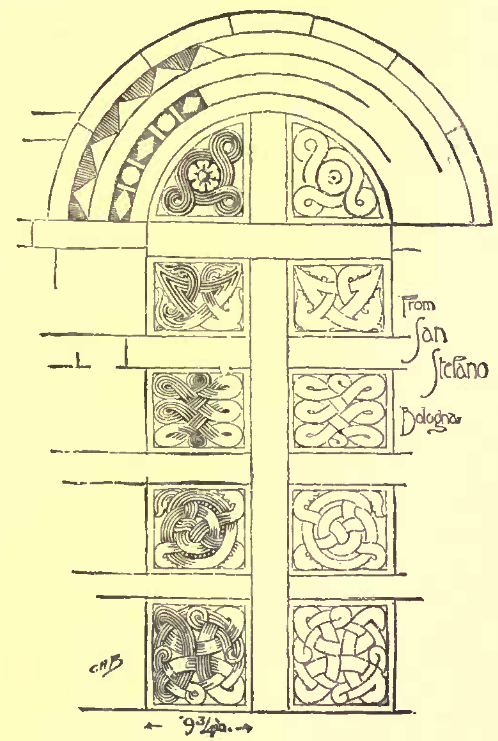
Doorway at Avila, Spain.
(Rep. Cen. Soc. Archts Paris.)



Portal of the C.urch "Dalbade." Toulouse, France.



Portal of the Church of the Convent at Assisi, Italy.



DOORWAYS.

Roman roads — are kept in their former positions, and good roads, ninety feet wide, are made from all the city gates. The Cathedral comes in a grand position at the junction of the two principal streets, and the Royal Exchange, with all the principal city offices and guilds grouped round it, stands in the centre of a noble piazza close to London Bridge, and forming a nucleus towards which most of the important streets converge. The churches, each with a good space in front of it, are arranged in the best possible position for sight and approach, while the great circles or piazzas in which the principal thoroughfares intersect give fine opportunities for architectural effect, besides assisting traffic in an admirable manner.

A wide wharf forms a worthy embankment for the river along the whole length of the city, approached at all points of importance by wide roads intersecting the city in all directions. The Fleet river — now unfortunately running underground as a huge sewer — was to be cleansed and widened so as to be available for shipping purposes, and spanned by bridges in several places. The principal streets were to be ninety feet wide, others sixty feet, and none less than thirty. All the principal buildings and markets were to have thoroughly good approaches, and it is a lasting pity that this scheme was never realized; for, besides the architectural dignity it would have fostered, it would have obviated in great measure the constant congestion of traffic which is the bane of modern policeman and man-of-business. The rights of ground owners and their eagerness to begin rebuilding without loss of time proved too strong for Parliament to cope with, and the city was rebuilt on the old lines and with the old narrow streets in most cases; even the most necessary feature, and one that Wren struggled hard for, the river quay, being sacrificed to the cupidity of unreasonable individuals. Wren succeeded in getting a Building Act passed in Parliament regulating the description of materials and such matters, but otherwise he was not able to control in any great measure the erection of private buildings in the new city. He acted as district-surveyor himself, and put down, with a high hand, any attempts at mean and unsanitary building.

In his general capacity as architect for the rebuilding of London, Wren directed nearly, if not quite, all the public buildings erected in the city until the time of his retirement. It is in these buildings — the churches and steeples chiefly — that Wren's wonderful originality of conception, and the versatility of his genius, are shown forth to the utmost; for he was, I believe I am right in saying, acting entirely without precedent in nearly all of them.

Of course, as has often been pointed out, these spires are built to some extent on the lines of the old Gothic ones; but really, in the case of most of them, beyond the fact that the towers have high tapering tops to them after the manner of the Gothic ones, the resemblance is not very apparent. Very few of Wren's spires are mere high-pitched roofs, like Gothic spires, but artfully-contrived and admirably-grouped stages, gradually receding so as to give the roof-like outline. In nearly all these — that is to say, the stone ones — Wren's favorite "cone" has been applied to carry the central mass of stonework from the walls of the tower, and Wren had ample opportunities for testing the qualities of this arrangement before applying it in the dome of St. Paul's. It is a noticeable feature in these steeples that they always start clear from the ground, instead of, as in many later works, off a pediment or roof, thereby losing partly the effect of the total actual height. The finest of these steeples is undoubtedly that of the church of St. Mary Arcubus, or le-Bow, begun in 1671 and finished five years later. The first church built on the site of the present one was a work of William the Conqueror's time. This church, being built on marshy ground was raised up on great arches well above the ground, a circumstance from which it took its name. The Court of Arches received its name in the same way, the meetings of this court being formerly held in the church.

Underneath the remains of this church, destroyed at the time of the fire, Wren found the walls and windows and pavement of a Roman temple which formerly stood there, and on these walls, as foundation, Wren built his church. The steeple, seeming to need better foundation than this, the excavation for it was carried farther down, and a Roman causeway, about four feet thick, formed of great stones firmly cemented, was discovered eighteen feet below the pavement. This causeway formed part of one of the principal streets of the Roman city, and was of so firm a character and in such good preservation that Wren adopted it at once as his foundation, and proceeded to rear the finest steeple he ever built, and I suppose the most beautiful Classic one in existence. The total height is two hundred and twenty-two feet, and the construction throughout is admirable and ingenious. It would take too long to go through the list of the spires of these city churches, and they are too well known to need much description. St. Bride's, Fleet Street, and St. Magnus the Martyr, at London Bridge, are two of the best of the stone ones. The former one is arranged after the fashion of a Chinese pagoda, with regularly diminishing stages, reaching to a total height of two hundred and thirty feet. This, again, is built upon the cone system. St. Magnus's spire, built 1705, is usually considered the second best of Wren's spires, but it is to my mind rather unpleasing in outline. These stone steeples of Wren's, though not in all cases as successful as might be wished, formed a starting from which later men developed such beautiful works as St. Clement Danes and St. Martin-in-the-Fields, steeples which seem to leave little more to be done for the attainment of perfection. The most picturesque of Wren's works are, of course, the lead spires and turrets which he has dotted here and there all over the city. Here, again, starting boldly on an entirely new departure, he has produced a series that would be a worthy result for a long course of development. They are of all possible kinds and shapes, from the formal and severe Gothic type, such as St. Swithin's, Cannon Street, or St. Margaret's, Rood Lane, to the quaintest and most fantastic compositions of arches and scrolls, pediments and obelisks, as at St. Faith's, Watling Street, or St. Edmund's, Lombard Street. A very favorite one is that on St. Martin's Church, Ludgate Hill, which forms, when seen with the dome of St. Paul's, a most beautiful composition, and one that cannot fail to strike even a casual beholder. To my mind, one of the very best of these lead turrets is that on the tower of St. Benet's, Paul's Wharf, a church built in 1683, of brick with stone dressings. Both the church and tower are very unlike Wren's usual work, and so successful in color and composition and so picturesque that it is always a wonder to me he did not do more work of a similar character. St. Peter's, Cornhill, is another church with a brick tower and a lead turret, very well proportioned, and of decidedly good outline.

There are many of Wren's towers finished as towers only, without turrets or visible roofs of any sort, but they are not among his most successful works. I fancy that many of them were intended to have lead turrets, which were omitted through lack of funds. One of these—St. Mildred's, in the Poultry—was pulled down in 1872 for street improvement, and was about to be ground up for Portland cement, but a kind-hearted man named Fytche bought it to save it from this degradation, and in hope of being able to rebuild it. The stonework is at present lying in a field on the east coast of Lincolnshire.

Wren's Gothic towers, with the exception of the one belonging to Christ Church, Oxford, come under this category, all being finished with angle turrets, as, for instance, St. Michael's, Cornhill.

A very interesting church, particularly so far as the interior is concerned, is that of St. James, Piccadilly. The nave has a barrel-vault in plaster, forty feet in span, with tranverse vaults at right angles with it over the aisles. The roof is a fine piece of construction. The whole span of sixty-eight feet is taken by one pair of rafters, and the necessity for a cross-tie is obviated by framing the ends of these rafters into a triangle between the transverse vaults, the thrust being still further opposed by the joists of the lead flat over the aisles.

After Wren had finished his London churches, an Act was passed in 1708 for building fifty new additional parish churches in London and Westminster, and he was appointed as one of the Commissioners for carrying out the Act. He accordingly wrote a lengthy report for the guidance of the various bodies who had in hand the erection of these churches, embodying the experience and wisdom he had collected in the building of his own churches. Among other things, he recommends that churches should be built in the wealthiest parts of the town, so as to be sure of resources for repairs and maintenance at all times, although the first cost would be greater than when building in the suburbs. Church-yards, he insisted, should always be placed outside the town, for manifold reasons. He considers that in ordinary churches there should not be more than fifty feet of space in front of the preacher, thirty feet each side and twenty feet behind, as he considers that a moderate voice cannot be heard well beyond these distances.

Besides his churches, Wren did a good deal of other work in and about London. The Monument, built 1671–1677, to commemorate the Great Fire, is a work of his much abused, but still not so bad as it might have been, for the first design showed it with an ornament of sculptured flames coming out of the windows. In 1668 he built the new Custom-House, subsequently pulled down and rebuilt by Smirke.

The entrance to the Middle Temple from Fleet Street is a nice piece of Wren's work in brick and stone, bold and refined, and of good proportions.

At Greenwich, as is well known, Wren built one of his most important works, the Hospital for Seamen, commenced in 1699. The site had been originally appropriated by Charles II for a royal palace, and the building was commenced by him. Inigo Jones had also built a house for the Queen Henrietta Maria on part of the site; and Queen Mary, when she took up the scheme for building the hospital at Wren's suggestion, insisted on retaining these two buildings as part of the new scheme, as well as on carrying out the four pavilions suggested by Inigo Jones, so Wren made his arrangements to fall in with these requirements, and I think it will be considered that he achieved an undoubted success. It should be stated, that, although Wren originated and carried through the idea of this hospital, he received no pecuniary reward whatever for his services in connection with the building. His work, although strenuous and constant, was entirely gratuitous.

The Greenwich Observatory had been built before this time — in 1675. The correct position for the building, as well as the design and carrying out of it, was settled by Wren, whose skill in astronomical matters was considered as great as that of any of his contemporaries. The Chelsea Hospital is a less important work than its fellow at Greenwich, but still possessing qualities that many buildings of a more ambitious character would do well to emulate.

But perhaps the most successful of all Wren's buildings of a semi-domestic character is the addition to the palace of Hampton Court that he carried out for William and Mary. He has contrived to combine in a wonderful manner the dignity and stateliness that undoubtedly should be the prominent characteristics of such a building with a cheerful and homelike character seldom even attempted by

the builders of palaces, and very rarely attained to by them. This work was begun in 1690, and finished in 1694.

An important early work by Wren is the Sheldonian Theatre at Oxford, the roof of which—a flat ceiling carried over a clear span of seventy feet by principals of very low pitch — is an equally daring and successful piece of carpentry. The tie-beams are jointed up in six or seven pieces.

The influence of Wren's work on the architecture and architects of the succeeding generation was, of course, very considerable. The foremost and most able of his successors, James Gibbs, was a pupil of Wren, and intimately associated with him in some of his important works. Vanbrugh, another man of great power, was Wren's pupil, and acted as clerk-of-works to him at Greenwich. Another, Nicholas Hawksmoor, carried out many of the churches under Queen Anne's Act. His work was less beautiful than that of Gibbs, but decidedly original and characteristic. Several other men, such as Strong—Wren's head-mason at St. Paul's, and afterwards an architect of no little ability—received their training under Wren's guidance. His association with Cibber and Grinling Gibbons, the sculptors employed on most of his principal buildings, is too well known to need comment. A well known and beautiful work by the latter is the pedestal of the statue of King Charles at Charing Cross.

Many important buildings—such, for instance, as the Royal Palace at Winchester—received their direction at Wren's hands, but it would take too long, in a paper of this kind, to enter into a dissertation on their character and merits. They are mostly well known, and generally associated with the name of their author.

It seems almost incredible that a man of such wide tastes and of such minute study in the direction of each bent of his mind could have achieved so much and such successful work in the one special art that he practised; but it has to be remembered that he enjoyed a length of life that has been rivalled among artists only by such men as Michael Angelo and Turner. He died in 1723, in his ninety-first year, having retired from public service only four years previously.

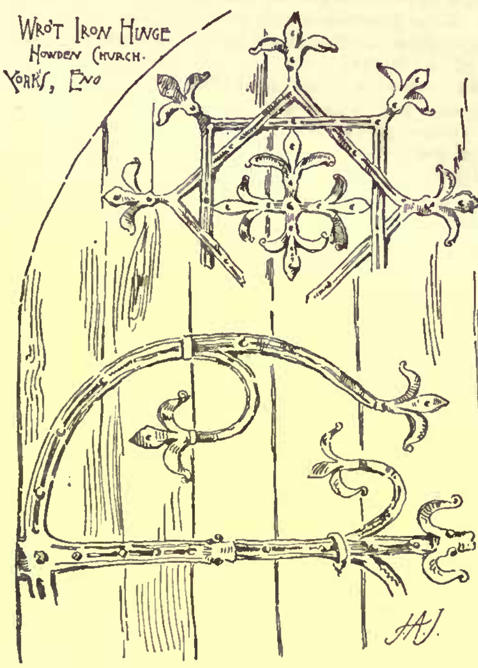
He was elected as a representative in Parliament two or three times, but only sat in one Parliament, his seat on the other occasions being lost on appeal. He received the honor of knighthood in the year 1673.

A life work such as Wren's could never have been carried out had not circumstances been fully ripe for the support of a great architect's career when he appeared on the scene. As James Elmes says in his "*Memoirs*," "When monarchs like Charles and James patronize architecture as they did; when statesmen like Buckingham, Richelieu and Colbert, and magnates like Pembroke and Bedford, encourage it from conviction of its importance; when legislators like Bacon, ambassadors like Wooton, and architects like Jones study, practise and write upon it and its principles, the art is ennobled and ennobles, and *must* flourish. Jones and Wren, two of the greatest names in our history, *loved* architecture *as an art, practised* it as a *profession*, but *despised* it as a *trade*." And when we think of the opportunities that Wren enjoyed—opportunities perhaps never before given to a single man—on the one hand, by the total destruction of the city he lived in by fire, and, on the other hand, by the innate love of magnificence and art which distinguished his royal patrons, coming immediately upon the excellent training which he had had to take a leading place in the affairs of his time, it is hardly surprising that he succeeded so steadily in almost every effort he applied himself to, and attained to the high position he occupies in the respect of his own and all succeeding generations.

The inscription placed on Wren's tomb in the Cathedral by his son, whereof the following is a translation, is very apt and appropriate: — "Beneath is laid the Builder of this Church and City, Christopher Wren, who lived for more than ninety years, not for himself, but for the good of the State. Reader, if thou askest for a monument, look around thee."

The Pope's Attitude toward Cremation.—The Vatican has taken a singular step with reference to the cremation question. It has all along viewed with disfavor a form of sepulture which is at least chronologically pagan. But though cremation made its great start in Italy, its progress there has been comparatively slow. Milan remains the headquarters of a system not yet introduced into Rome, and even in Milan, though the mortality keeps its full average, the furnaces are but seldom kindled. The Italians, as a people, are slow to take up "fads," and are accustomed to find the State interest itself in ventures which in other countries are left to private speculation. The new decrees dealing with the question are very wide in their application and very peremptory in their terms. All faithful Catholics are forbidden to affiliate themselves with any cremation society, and no one is to be permitted to order or facilitate cremation, even when the testator should have directed this kind of sepulture for himself, and his executors and next of kin are desirous to carry out his wishes. Of course these decrees do not override the law of the land, though they accentuate the distinction between the Pope's authority and that of the Italian Legislature. In Germany they will probably have no influence at all, and, presumably, not very much across the Atlantic, but in France and Italy the cause of cremation may receive a temporary check.—*Pall Mall Gazette.*

THE NEW YORK CITY LUMBER INSPECTION.



RECENT persistent and virulent attacks on the inspection of lumber in the New York City markets have attracted wide attention. To meet these attacks Mr. P. Moore, an experienced inspector of that city, has prepared the following synopsis of the inspection rules that have been in operation in New York for years. As presented in the columns of *The New York Lumber Trade Journal*, the rules are as follows:

Black Walnut. — Black walnut is generally inspected in three grades, viz., firsts, seconds, and culls. In some cases, more particularly in low grade lumber, it is inspected into five grades, viz., firsts, seconds, rejects, culls and mill culls. *Firsts* must be 8 inches and over in width, and 10 feet and up in length. Eight to 11 inches must be clear and free from all defects. Twelve to 18 inches will admit of a slight defect. It may show sap on one side, or on one or both edges, not to exceed 2 inches, or one standard not to show on one side. Eighteen inches and over will admit sap on one or both edges, not to exceed 3 inches, or two standard knots to show only on one side, or one standard knot to show on both sides, or 12 inches and over will admit a split of 18 inches. More than one of these defects will reduce it to a second. Eight feet long, to be admitted in the first grade, must be 12 inches and over in width and free from all defects. Uneven, badly-sawed, and scant thickness will not be admitted, but will fall to the next grade, unless the thickness varies considerably, say $\frac{1}{4}$ of an inch or more, when it should be classed as a cull. *Seconds* must be 6 inches and over in width and 8 feet and up in length. Six to 8 inches wide, must have a clear face and not show more than one-half sap on other side, or may have two knots to show on one side. Nine to 12 inches wide will admit three standard knots, or 4 inches of sap to show only on one side, may be on one or both edges, not to exceed 4 inches, or in that proportion. Defects may increase in proportion to the width of the board or plank. In boards or planks of good widths the defects may be one large rotten knot, or may have a bunch of worm-holes when otherwise free from defects. This must be left to the judgment of the inspector, as the location of such defects would be very material. *Culls* include all lumber not up to the standard of seconds. All heart, wormy, shaky and miscut lumber should be classed as culls, except such as do not contain one-half sound, merchantable stock, which would be classed as mill culls. *Rejects* are line boards or plank on seconds and culls, and narrow sap culls, showing black face, also boards or plank of good widths, with a sound, straight heart, when otherwise free from defects.

Butternut, sycamore and sweet gum are inspected the same as walnut.

Joists. — Walnut joists running from 3 inches by 3 inches to 10 inches by 10 inches are inspected in three grades, viz., firsts, seconds, and culls. *Firsts* must be ten feet and up in length, sound and free from all defects, sawed square and full size. *Seconds* must be free from all heart shakes, checks and splits. Joists of 10 and 12 feet will admit two standard knots. Fourteen and 16 feet will admit four standard knots, or may show 2 inches of sap on two corners if otherwise free from defects. Defects may be in proportion to the above, which are based on the size of 6 inches by 6 inches. *Culls* include all stock not up to the standard of seconds, including all heart, very sappy, or badly checked stock, except such as are all heart or rotten, which would be worthless. Cherry joists are inspected the same as walnut, except for gum. Slight gum specks will be admitted in the first and second grades. Very gummy joists should be classed as culls. Ash and maple joists are inspected the same as walnut, except that sap, when sound and bright, is not considered a defect.

Cherry.— Cherry is generally inspected in three grades, viz., firsts, seconds, and culls. In some cases, more particularly in low grade lumber, it is inspected in five grades, viz., firsts, seconds, rejects, culls and mill culls. *Firsts* must be eight inches and over in width and 10 feet up in length. Eight to 11 inches must be free from defects. Twelve to 18 inches will admit a slight defect. It may show sap on one or both edges not to exceed two inches, or one standard knot to show only on one side. Eighteen inches and over will admit 4 inches

of sap, or two standard knots, to show on one side, or one standard knot, to show on both sides. Twelve inches and over will admit a split of 18 inches. When more than one of these defects is found it will reduce it to a second. When free from other defects, sound, slight gum specks will be admitted. Eight feet long to be admitted must be 12 inches and up in width and free from all defects. Scant thickness or badly-sawed lumber will not be admitted in this grade. *Seconds* must be 6 inches and over in width and 8 feet and up in length. Six to 8 inches must show clear face, and not more than one-third sap on other side, or may have two standard knots. Eight to 12 inches will admit three standard knots, or will admit sap to show only on one side, may be on one or both edges, not to exceed 4 inches. Defects may increase in proportion to the width. Gummy lumber will be admitted, when not too bad; this must be a matter left entirely to the judgment of the inspector, as to the amount of waste, etc. A board or plank of good width may have one large defect, such as a rotten spot or bunch of worm holes, or similar defects, which would be classed owing to the location and the amount of waste caused by such defects. *Culls* include all stock not up to the standard of seconds, and all heart, wormy, and very gummy boards, or plank, except such as do not contain one-half of sound, merchantable stock, which would be classed as mill culls. *Rejects* are liner boards, or plank, or seconds, and culls, and narrow sap culls, showing one good side, also boards, or plank, of good widths, with a sound, straight heart, when otherwise free from defects. *Strips* consist of 1 inch and 1¼ inches, clear, and clear face, running from 4 to 6 and 7 inches.

Ash.— Ash is inspected in three grades, viz., firsts, seconds, and culls. *Firsts* must be 8 inches and over in width, and 10 feet and up in length. Must be free from defects to 12 inches. Twelve to 18 inches will admit one standard knot, to show only on one side. Eighteen inches and over will admit two standard knots to show only on one side, or 12 inches and over will admit a split of 18 inches in one end if otherwise free from defects. Sap is not considered a defect when sound and free from discolor. *Seconds* must be 6 inches and over in width. Six to 8 inches must be free from defects. Eight to 12 inches will admit two standard knots. Twelve to 16 inches will admit three standard knots or defects in proportion. Sixteen inches and over will admit four standard knots. Heart or dozy boards or plank will not be admitted in this grade. *Culls* include all stock not up to the standard of seconds, including all heart, dote, dead doty, or stained stock, except such as do not contain one-half sound, merchantable stock, which should be classed as mill culls.

Elm is inspected the same as ash.

Oak.— Oak is inspected into three grades, viz., firsts, seconds, and culls. *Firsts* must be eight inches and over in width and 10 feet and up in length. Eight to 12 inches must be clear. Wide boards or plank will admit a split of 18 inches on one end, or two standard knots to show only on one side, when free from other defects. Slight surface checks will be admitted in thick plank. Wormy or stained stock will not be admitted in this grade. *Seconds* must be 6 inches and over in width and ten feet and up in length. Six to 8 inches must show one good side. Eight to 12 inches will admit three standard knots. Wide boards or plank will admit proportionate defects. Stock damaged by heating, or wormy, will not be admitted in this grade. *Culls* include all stock not up to the standard of seconds, including all heart, wormy and badly checked stock, except such as do not contain one-half sound, merchantable stock, which should be classed as mill culls.

Quartered Oak.— Quartered oak is inspected in three grades, viz., firsts, seconds, and culls. *Firsts* must be 6 inches and over in width and 10 feet and up in length. Must be free from all defects to 9 inches. Ten to 12 inches will admit one standard knot to show only on one side, or proportionate defects in wider stock. *Seconds* must be 4 inches and over in width and 10 feet and up in length. Four and 5 inches must be free from defects. Six to 9 inches will admit two standard knots. Wide boards or plank will admit proportionate defects. In boards or plank of good width the defects may be one large rotten knot, or may have a bunch of worm holes, when otherwise free from defects. *Culls* include all stock not up to the standard of seconds, all heart, wormy, stained, damaged by heating, or otherwise defective, except such as do not contain one-half sound, merchantable stock, which should be classed as mill culls. *Narrows*, 1 inch and 1¼ inches, are clear strips running from 3 to 6 inches in width. Must be 10 feet and up in length.

Hickory is inspected the same as oak.

Whitewood.— Whitewood is generally inspected in three grades, viz., firsts, seconds, and culls, and also a grade termed common. *Firsts* must be 10 inches and over in width and 10 feet and up in length, and must be clear and sound to 12 inches. Twelve to 15 inches will admit one inch of bright sap. Sixteen inches will admit 2 inches of bright sap, to show only on one side. Eighteen inches and over will admit three inches of bright sap, or one standard knot to show on one side. Twelve inches and over will admit a split of 1 foot, in lumber 12 feet long; 14 and 16 feet will admit a split of 18 inches in one end. When more than one of these defects is found, it will reduce it to a second. Scant thickness or unevenly-sawed lumber will not be admitted in this grade. *Seconds* must be 6 inches and over in width and 10 feet and up in length. Six to 8 inches must be free from defects. Eight to 12 inches will admit 4 inches of sap to show only on one side, or two standard knots. Over 12 inches will admit one-third sap to show on one side. When free from other defects will admit three standard knots. Defects may increase in proportion to width. Stock stained or damaged by heating will not be admitted in this grade. *Culls* include all lumber not up to the standard of seconds, including all heart or otherwise defective, except such as do not contain one-half sound, merchantable stock, which should be classed as mill culls. *Common* are liner boards or plank or seconds, culls, and bright sap culls, wide sound heart boards, or plank, or large cutting-up boards or plank, when otherwise good.

Joists.— Joists, running from 4 x 4 to 12 x 12, are inspected in three grades, viz., firsts, seconds, and culls. *Firsts* must be 10 feet and up in length, sound and free from all defects, sawed square, and full size. *Seconds* must be sound, free from heart, shakes and checks. Ten to 12 feet will admit two standard knots, or may show 2 inches of sap on two corners. Fourteen and 16 feet will admit four standard knots. These defects are based on size 6 x 6. Other sizes may be admitted with proportionate defects. *Culls* include all not up to the standard of seconds, including heart, very sappy, badly-stained, or checked stock, except such as are all heart or rotten, which would be worthless.

Cottonwood.— Cottonwood is inspected in three grades, viz., firsts, seconds, and culls. *Firsts* must be 8 inches and over in width and 10 to 16 feet in length, clear and free from defects to 12 inches. Twelve to 18 inches will admit bright sap on one or both edges, not to exceed 2 inches, and to show only on one side, or one standard knot to show on one side. Eighteen inches and over will admit two standard knots, or bright sap on one or both edges not to exceed 3 inches, to show only on one side, or will admit a split of 18 inches. When more than one of the e defects is found it will reduce it to a second. *Seconds* must be 6 inches and over in width and 10 feet and up in length. Six and 7 inches must be clear. Eight to 11 inches will admit two standard knots, or sap to show on one or both edges not to exceed 4 inches. Defects may increase in proportion to width. *Culls* include all lumber not up to the standard of seconds, including heart, shaky and stained stock, except such as do not contain one-half of sound, merchantable stock, which should be classed as mill culls.

Basswood is inspected the same as cottonwood.

Maple.— Maple is inspected in three grades, viz., firsts, seconds, and culls. *Firsts* must be 8 inches and over in width and 12 feet and up in length. Must be clear and free from defects to 12 inches. Twelve inches and over will admit one standard knot, to show only on one side, or a split of 18 inches, when free from other defects. Sap is not considered a defect, when sound and bright. *Seconds* must be 6 inches and over in width an l 10 feet and up in length. Up to 10 inches will admit two standard knots. Wider stock will admit proportionate defects. Stock damaged by heat or stain will not be admitted in this grade. *Culls* include all stock not up to the standard of seconds, including all heart, dry-rot, shaky and badly-checked stock, except such as do not contain one-half sound, merchantable stock, which should be classed as mill culls.

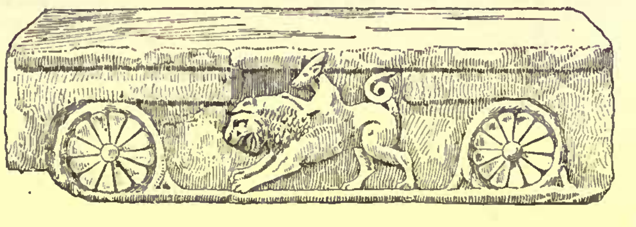
Birch and beech are inspected the same as maple.

Chestnut.— Chestnut is inspected in three grades, viz., firsts, seconds, and culls. *Firsts* must be 8 inches and over in width and 10 feet and up in length. Eight to 12 inches must be free from defects. Twelve to 18 inches will admit one standard knot to show only on one side. Eighteen inches and over will admit two standard knots to show only on one side. Twelve inches and over will admit of a split of 18 inches. *Seconds* must be 6 inches and over in width and 10 feet and up in length. Eight to 12 inches will admit three standard knots. Twelve inches and over will admit four standard knots. A board or plank of good width may have one large defect, such as a rotten spot, a bunch of worm holes, or similar defects, which would be classed owing to the location and the amount of waste caused by such defects. *Culls* include all lumber not up to the standard of seconds, except such as do not contain one-half of sound, merchantable stock, which would be classed as mill culls.

Scant or Tapering Lumber.— In measuring 1¼ inch, 1½ inch, 2 inch and 2½ inch lumber, when more than $\frac{1}{16}$ of an inch scant, it should be reduced in measurement to next thickness. Thick plank ⅛ of an inch scant should be measured full. But a large proportion of lumber $\frac{1}{16}$ of an inch scant, or plank ⅛ of an inch scant, would not be merchantable lumber, and would be subject to deduction in measurement, or otherwise. Tapering lumber should be measured one-third distance from the narrow end. The above rule can vary in regard to lengths or widths, or subject to any mutual agreement; and when such exceptions are made, it should be so described on the inspection returns. In reference to contracts as to specific widths or lengths, the inspection would be subject to such agreement or contract.

Notes.— Dimension stock sawed to order, any given length, or fractional foot thereof, or any size, or fractional inches in size, should be measured actual contents. All wavy stock would be subject to a liberal allowance in measurement. A large quantity of lumber, running largely wavy edge, would not be generally considered merchantable, except such as second growth stock, or stock sawed for a special purpose. A standard knot is considered 1¼ inches in diameter, and sound when the full limits are found. If less knots, greater allowances will be made as to their character. Standard thicknesses are ⅝ inch, 1 inch, 1¼ inch, 1½ inch, 2 inch, 2½ inch, 3 inch, 4 inch, 5 inch and 6 inch. Standard lengths are 12, 14 and 16 feet, also 10 feet are generally so considered. In cherry and walnuts, 8-foot lengths are also recognized.

COMPARATIVE VALUE OF DIFFERENT KINDS OF WOOD AND COAL FOR FUEL.



A late issue of the *Locomotive* gives the following table showing the weight of one cord of various kinds of wood, dry, and their relative values for fuel, red oak being taken as the standard :

Kind of wood.	Weight of one cord in lbs.	Relative value for fuel.
Red oak	3,254	1.00
Shell-bark hickory	4,469	1.45
Chestnut white oak	3,955	1 25
White oak	3,821	1.17
White ash	3,450	1.12
White beech	3,236	0.94
Black walnut	3,044	0.94
Black birch	3,115	0.91
Yellow oak	2,919	0.87
Hard maple	2,878	0.87
White elm	2,592	0.84
Large magnolia	2,704	0.81
Soft maple	2,668	0.78
Soft yellow pine	2,463	0.78
Sycamore	2,391	0.75
Chestnut	2,333	0.75
White birch	2,369	0.70
Jersey pine	2,137	0.70
Pitch pine	1,904	0.62
White pine	1,868	0.61

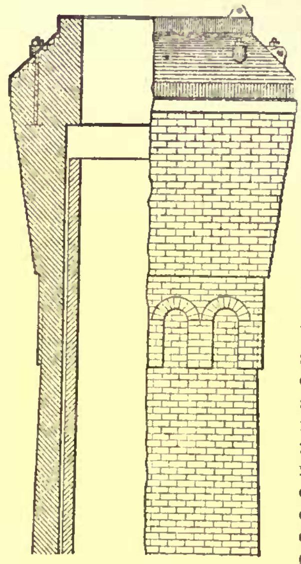
The values given above are from Knapp's "*Chemical Technology*."

The following table, useful in connection with the preceding one, is reproduced from the *Locomotive* of May, 1883. It shows the value of different coals for fuel purposes, the comparison being made with oak wood as the standard :

	Designation of coal.	Mine, where located.	Percentage of combustible in coal.	Lbs. water evaporated per lb. of coal from atmos. press. and 212°.	Equivalent in lbs. of coal per cord of standard oak.
1	Semi-bituminous, Standard Coal Co.	Brothers Valley, Somerset Co., Pa.	88.99	9.85	1,521
2	Semi-bituminous, Philson Iron Coal Co.	Berlin, Somerset Co., Pa.	90.92	9.75	1,537
3	Forest Improvement anthracite	Richardson colliery, Schuylkill Co., Pa.	79.43	9.37	1,598
4	Wilkesbarre anthracite	Black Diamond, Northumberland Co., Pa.	80.77	9.37	1,598
5	Scranton anthracite, D. & H. Canal Co.	Luzerne Co., Pa.	77.3	9.28	1,614
6	Lykens Valley anthracite	Dauphin Co., Pa.	83.97	9.07	1,651
7	Bit. coal, Simpson, Horner & Sons	Monongahela River, Pa.	92.15	9.07	1,653
8	Los Cerrillos anthracite	Ortez grant, New Mexico	88.25	9.04	1,657
9	Scranton anthrac., D., L. & W. R. R. Co.	Luzerne Co., Pa.	82.85	8.87	1,687
10	Bituminous coal, T. Fawcett & Sons	Near Pittsburgh, Pa.	94.04	8.78	1,706
11	Los Cerrillos bituminous	Ortez grant, New Mexico	86.74	8.60	1,742
12	West Virginia splint	Paint Creek, West Virginia	91.90	8.34	1,796
13	Free-burning medium hard	Raven Run mine	81.20	8.24	1,818
14	McAllister coal	Tobosky Co., Choctaw Nation, Ind. Ter.	94.20	7.68	1,950
15	Scotch splint (Duke of Hamilton)	Glasgow	93.28	7.61	1,970
16	Davison, West Hartley	West Hartley district	94.01	7.60	1,970
17	South Wellington coal	S. Wellington col'y, Departure Bay, V. I.	91.83	7.59	1,974
18	Cowpen, West Hartley	Cowpen colliery, Newcastle-upon-Tyne	93.89	7.54	1,993
19	Bituminous coal, Mitchell & Co.	La Plata mine, near Fort Lewis, Col.	89.10	7.49	2,000
20	Indiana cannel coal	Daviess Co., Ind.	75.18	7.32	2,040
21	Nanaimo coal	Chase River, Nanaimo, Vancouv. Island	86.76	7.30	2,070
22	Cowpen Cambois, West Hartley	West Hartley district	93.79	7.04	2,129
23	Wellington coal	Wellington mine, Departure Bay, V. I.	90.62	6.71	2,233
24	Bituminous Leavenworth coal	Leavenworth Coal shaft, Leaven., Kas.	88.91	6.49	2,307
25	Bituminous cañon coal	Coal Creek colliery, Fremont Co., Col.	90.	6.45	2,323
26	Bituminous coal	Chestnut mine, Rock Creek Cañon, Mon.	67.57	6.07	2,466
27	Rocky Mountain coal	Rock Spring mine, Nebraska	93.50	6.01	2,491
28	Eastport, Coos Bay coal	Mine at the head of Coos Bay, Oregon	91.16	5.24	2,859
29	Pittsburgh coal	Pittsburgh Mount Diable mine, Somersville, Contra Costa Co., Cal.	89.	5.05	2,965
30	Weber coal	Chalk Creek, Summit Co., Utah.	89.98	4.73	3,168
31	Lignite coal	Military Reservation, Ft. Stevenson, Dak.	93.77	4.03	3,712

The two tables enable a comparison of the comparative values of any wood and coal to be made. The latter table is from a report on fuel for the army, by Quartermaster-General M. C. Meigs. The value of wood as a fuel depends greatly on its dryness. After two years of natural seasoning it may contain from twenty to thirty per cent of water, the amount of seasoning depending greatly on the condition of the wood, whether sawed, split, or left in its natural state. The calorific power for equal weights of all woods is substantially the same, being about seventy-two hundred thermal units for one pound of dry wood, and sixty-four hundred units when it contains twenty per cent of water.

CHIMNEY CONSTRUCTION.



The *Locomotive*, which in nearly every issue supplies sermons of the utmost value to steam-users and boiler-owners, in a recent number speaks as follows of chimney construction :

The important part fulfilled by a chimney renders it especially desirable that it should be of ample size, well proportioned and properly built. The function of a chimney is primarily to furnish a sufficient supply of oxygen to the fuel to effect its combustion. The first point to be considered is stability. This is sometimes a matter of some difficulty, but if proper care is exercised the condition may always be attained. A good foundation is the first requisite. Most failures of chimneys have occurred through insecure foundations, which have settled unequally. Where practicable, the load on a chimney foundation should not exceed two tons per square foot in compact sand, gravel or loam. Where a solid-rock bottom is available for foundation, the load may be greatly increased. If the rock is sloping, all unsound portions should be removed, and the face dressed to a series of horizontal steps, so that there shall be no tendency to slide after the structure is finished.

One very strong reason for making a chimney foundation as broad as possible is the fact that in high winds the pressure on the foundation may be largely concentrated on the leeward side of the shaft, so that in some localities where the prevailing winds are quite strong their effect alone may be sufficient to cause unequal settling, unless precautions are taken that the foundation is amply large. But in ordinary cases, with short stacks, no trouble need be experienced, for if the base of the foundation be only slightly larger than the shaft, it

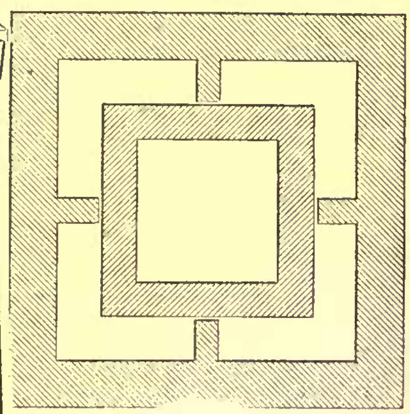


Fig. 4.



Fig. 3.



Fig. 2.

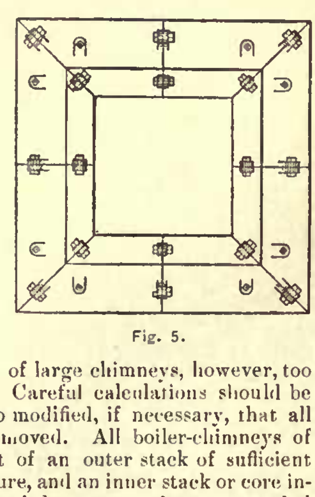


Fig. 5.

will be sufficiently firm. In the case of large chimneys, however, too great caution cannot be observed. Careful calculations should be made, and the design of the stack so modified, if necessary, that all doubt regarding stability may be removed. All boiler-chimneys of any considerable size should consist of an outer stack of sufficient strength to give stability to the structure, and an inner stack or core independent of the outer one. This core is by many engineers extended

up to a height of fifty or sixty feet from the base of the chimney, but the better practice is to run it up the whole height of the chimney; it may be stopped off, say, a couple of feet below the top, as shown in initial cut, and the outer shell contracted to the area of the core, as shown in the engravings; but the better way is to run it up to about eight or twelve inches of the top, and not contract the outer shell. But under no circumstances should the core at its upper end be built into or connected with the outer stack. This has been done in several instances by bricklayers, and the result has been the expansion of the inner core, which lifted the top of the outer stack squarely up and cracked the brickwork.

In the accompanying engravings Figure 2 shows an external and Figure 3 a sectional elevation of a chimney such as we would recommend for small batteries of boilers, where the height of the chimney does not exceed one hundred feet. For a height of one hundred feet we would make the outer shell in three steps — the first, twenty feet high, sixteen inches thick; the second, thirty feet high, twelve inches thick; the third, fifty feet high and eight inches thick. These are the minimum thicknesses admissible for chimneys of this height, and the batter should be not less than one in thirty-six to give stability. The core should also be built in three steps, each of which may be about one-third the height of the chimney —the lowest, twelve inches; the middle, eight inches, and the upper step, four inches thick. This will insure a good, sound core.

The Initial cut shows a plain, simple finish for a chimney-top, but one which looks neat if it is well proportioned. Care should be taken, however, that it is not made too short in proportion to the length of the shaft, or it will look "squat." The finish of a chimney should be such that it harmonizes with the style of the surrounding buildings. It costs no more thus, and looks vastly better. The top of a chimney may be protected by a cast-iron cap, Figure 5, or perhaps a cheaper and equally good plan is to lay the ornamental part in some good cement, and plaster the top with the same material.

COMMUNICATIONS

[*We cannot pay attention to the demands of correspondents who forget to give their names and addresses as guaranty of good faith.*]

BOOKS.

To the Editors of the American Architect: —

Dear Sirs,— Please give me, through your journal, the names of some of the standard books on Romanesque architecture in general, and also the best books on Norman architecture, and illustrated books on Byzantine ornamentation.

Yours very respectfully, J. G. Braecklein.

[(1.) Revoil's "*Architecture Romane du Midi de la France.*" (2.) Cotman's "*Antiquities of Normandy*," Pugin's "*Specimens of Anglo-Norman Architecture.*" (3.) Verneilh's "*L'Architecture Byzantine en France*," Heideloff and Görgel's "*Les Ornaments du Moyen Age.*" — Eds. American Architect.]

THE TERRACE OF THE CAPITOL.

Brookline, August 9, 1886.

To the Editors of the American Architect: —

Dear Sirs, — Your comments of the 7th inst., on the plan of this structure may make the following notes desirable:

1. The plan of the building makes a raised open walk adjoining three sides of it (which is a "terrace") indispensable, as a means of access to and of communication between several entrances. The grounds of the Capitol could not be laid out fittingly, except with carefully studied relation to a structure for this purpose. Hence the landscape architect was compelled to present a plan for it in connection with the plan for the grounds. "The flights of steps, parapets, balustrades, etc.," to which you refer as ornaments, are necessities of convenient use, and in no way more decorative than is required for unity of composition with the main structure. There is believed to be not a particle of "sham" in all of the terrace.

As to a possible difference of judgment growing out of the difference of habits of architects and landscape architects it is to be observed:

2. All the drawings before Congress illustrative of the plan of the terrace have been prepared in the offices of well-known architects, and bear their office stamps.

3. Before the plan was presented to Congress it was reviewed and approved by the architect of the Capitol.

4. Before it was adopted the plan was submitted for criticism to the architect of the Treasury and to the president of the American Institute of Architects, and was formally and unqualifiedly approved by each of them.

5. The landscape architect of the work entirely agrees with you that "for landscape gardening purposes" simple retaining-walls would be sufficient. He has from the first expressed this opinion. It was not from æsthetic reasons, therefore, as you pleasantly suggest, but from regard to utilitarian needs that the terrace is not to be a solid structure. A vain effort was, in fact, made to obtain the assent of Congress to such a mode of construction for a large part of the work.

Yours respectfully, O.

[We regret that Mr. Olmsted has not said something as to the feasibility of lighting some of the rooms from the outside, which is the only point at issue between him and Congress. For our own part we have expressed ourselves qualifiedly in favor of windows only on the supposition that the working convenience of Congress will be interfered with by reason of their absence. If the real economical and practical value of the new rooms is their capacity as storage rooms for rarely visited archives, the matter of external light is of no consequence, and the designing of the terraces architectually correct. As to the external architectural effect of the new work on the composition of the Capitol itself we have no more reason now than last week for supposing that it is not very nearly what it should be. — Eds. American Architect.]

BRICK WALLS.

Baltimore, Md.

To the Editors of the American Architect: —

Dear Sirs,— Will you be kind enough to tell me how to find the carrying capacity of brick walls? I am about to build a large warehouse, in which heavy weights and running machinery will be placed. I have looked through all the text-books I could find but do not find what I want. None of them seem to take the height or width of wall or pier into account. I should think that the height should be taken into account, if not the width. In case of using piers along the wall, would the part of the wall between piers be taken into account or not? If so, what proportion of strength would they add to pier? These piers support cross-girders. The stories are low, averaging 12′. By answering by mail as soon as possible, you will greatly oblige,

Yours respectfully, A. H. Bieler.

[Finding the same difficulty that our correspondent found — a difficulty that one usually experiences, by the way, whenever he seeks in books for a formula or statement which will exactly fit the case in hand—we applied to Mr. Berg for help, thinking that, as his attention is just now turned to such subjects, he might give a much more reliable answer than our own researches could evolve. Mr. Berg says: "Many of our large cities have building laws giving the required strengths of walls. As a rule, these are amply safe, unless the wall is riddled with flues or openings. In the latter case, each separate pier might be calculated as isolated piers by the method I have already given in 'Safe Building.' second article (latter part of article). The part of wall between the piers will add its own weight to that already on the pier, but, on the other hand, shortens the pier and prevents it from giving by buckling *into* the opening. To prevent bulging into the street, I should take the height of each story between girders as the height of the pier, and use formula given in my second article. In substituting the value for ρ^2 use the last column of Table I and Figure 3, viz.: $\rho^2 = \frac{d^2}{12}$. For d use the thickness of pier (wall) in the different stories. If the pier is very narrow (that is, not as wide as it is thick), it should also be figured, using height of opening as the height of pier, and using the width of pier for d (in place of thickness). The load on pier will be, of course, the whole load on pier above, plus one-half the load on girder (if girder is symmetrically loaded, as it probably is), plus one-half of brickwork each side between piers, plus weight of pier itself. This calculation supposes the pier to be well anchored to girder at each story. The amount to be allowed for $\left(\frac{c}{f}\right)$ depends entirely upon the quality of the brickwork. This can be found in column three of Table V of my articles. In regard to solid walls, be had better use the '*New York City Building Law*' as a guide."— Eds. American Architect.]

NOTES AND CLIPPINGS

A long Pendulum.— The longest clock pendulum in the world is at Avignon, France. It is 67 feet long, and requires 4½ seconds to swing through an arc of 9½ feet.—*Exchange.*

Equestrian Statue of Frederick William IV at Berlin.—The unveiling of the equestrian statue of the late King Frederick William IV at noon, June 15, was an impressive State ceremony. The monument represents the late king seated on a powerful horse, with allegorical figures of art, religion, history and philosophy seated at the four corners of the pedestal.— *London Times.*

The Royal Tomb at Munich.— The royal tomb in the cave under the Church of St. Michael, in Munich, in which the mortal remains of King Louis II were deposited, contains at present 23 coffins, including those of two Bavarian princesses—one the daughter of Emperor Charles VII, who died at 18 years, the other a daughter of the Duke Ferdinand Maria, who died at 20 years of age. Thus far the body of the late king is only incased in an oaken coffin, richly and artistically ornamented; in a week or two the wooden receptacle will be inclosed in an elaborately wrought metal one, bearing the name and the crown of the unhappy monarch.— *American Register.*

"Tuberculosis" in Cast-iron Water-pipes.— M. Lory, Dean of the Faculty of Sciences of Grenoble, applies the term "tuberculization" to a change to which cast-iron pipes are subject when they have to convey certain kinds of potable water, those which are purest according to the hydrometric scale being frequently those which cause the greatest trouble. The interior surfaces of the pipes attacked have upon them tubercles or ferruginous concretions, which gradually diminish the capacity of the pipes, and even in time entirely obstruct them. These concretions (which are formed essentially of hydrated peroxide of iron) are never found to contain traces of salts of lime, and when they are dissolved in dilute hydrochloric acid they leave as a residue from 5 to 15 per cent of vegetable matters, which are easily recognizable with a microscope, and among which a number of diatoms are often to be distinguished. This alteration in the constitution of the pipe is sometimes

noticeable after four months' use, and the operation of tarring is insufficient to arrest it. Experiments made by M. Thierwoz, engineer of the Grenoble Water Works, show that this corrosion of cast-iron is altogether independent of the electric phenomena resulting from the contact of the metal with the lead collars by which the pipes are connected. M. Lory recommends the immersion of cast-iron pipes in spring water for a period ranging from 10 to 12 months before they are laid, to insure them against corrosion. Manchester water has the above effect.—*Iron Age.*

A Nickel Lightning-rod.— Nickel is a metal which has properties similar to iron, but has the great advantage over the latter of not rusting in moist air. Iron is now used to a considerable extent for lightning-rods, but inasmuch as it rusts in the air, nickel is preferable. A rod of nickel has been tried on a building at Dresden, but not for sufficiently long to test its durability. Everything, however, is in favor of the new material, and it will be interesting to hear how it serves, as copper is, apart from its conductivity, not a particularly good material for lightning-rods.— *Engineering.*

Insects as Sanitary Inspectors.— The *Sanitarian* relates a case in which a rat had died under the floor of a large drawing-room and was giving great offence to the owner of the house, who had had the carpets and furniture removed preparatory to taking up the floor. An ingenious friend drops in, suggests that the doors and windows be shut, steps out to the stable and traps a couple of blue-bottle flies, and returning, sets them free in the apartment. The flies, after a little undetermined buzzing, settle pertinaciously on a certain crack in the floor, and on the removal of one plank at this point the cause of offence was readily removed.

Iron in the Confederacy.— "Iron was now the precious metal. War not only monopolized the entire product of the South, but so sore was the need that frequent calls were made for plantation bells to be cast into cannon. Many church bells were also given. In the cry for iron! iron! a large society of ladies undertook to furnish material for building an iron-clad by collecting all the broken pots, pans and kettles in the Confederacy. The home folk had to depend almost entirely on the reworking of old iron. An active and unremitting search was maintained for every superfluous or cast-away scrap. All old vehicles and farm implements, not absolutely indispensable, were demolished, and the iron they contained was diverted to the pressing needs of the moment. All idle nails were carefully drawn and laid away for future use. A sharp lookout was kept for stray pins. Womenkind made their boasts of the weeks and months they passed without missing a single pin; while the loss of a good darning needle would have been a calamity involving perhaps half a neighborhood. The rapidity with which such indestructible articles as pins, needles, buttons, etc., disappeared from the face of the earth after the blockade was established was as unaccountable as the speed with which larger things wore out. Many a hard-beset housewife, in her distress, 'vowed,' and half believed that the Yankee manufacturers, with a prophetic eye to the future, had purposely made the wares sent South of the most worthless description, in order that their collapse might embarrass us in the prosecution of the war."—*August Atlantic.*

Peasant Proprietorship in Norway.— Norway presents us with the grandest picture of the effects of peasant proprietorship. There the land has, from time immemorial, been the property of the laborer who tills it — it has never been poisoned by the foul curse of feudalism. The title-deeds of many of these peasant holdings are in a dead language, and the names of the peasants are those of the district. The results are marvellous. Land which no English farmer would or could cultivate under our agricultural system, even if receiving a liberal bounty per acre instead of paying rent, is there made to support whole families, and that by the same race as ourselves, and in latitudes hundreds of miles farther north than John o' Groat's house, some of it even within the arctic circle. Sailing along the arctic coast of Norway the tourist passes here and there little oases, called "stations," where the steam omnibus halts to land and embark a passenger or two. If a careful observer, he may learn that in the midst of the rocky desolation there is a deposit of rock fragments and gravel left by an ancient glacier in a hollow formerly filled by the ice. This is cultivated, is a dairy-farm and fishing-station, farmers and fishers being all freeholders and capitalists, no such class as laborers without property existing there. One of the grandest of the Norwiegan fjords is the Geiranger. It is walled by perpendicular precipices from 1,000 to 3,000 feet high. Sailing along the fjord a boat-house is seen here and there at the foot of the dark wall. Looking skyward directly above it may be seen what appear to be toy houses on a green patch. Closer observation reveals moving objects, a field-glass shows that they are cattle, goats and children, tethered to boulders to prevent them from straying over the edge of the precipice. A family resides up there, cultivating this bit of ancient glacier ground, backed by craggy mountain tops, with a foreground of precipice above the fjord. The only communication between these eagle-nest farms and the outer world is by the boat below. How that boat is reached, where is the staircase of ledges on the face in the precipice, is incomprehensible to the passing tourist. In most cases no indication of a track is visible. Nothing but absolute proprietorship by the cultivator could bring such land into cultivation. Latitude 62°, altitude 2000 and 3000 feet, summer three to four months long; the ground covered with snow during six to eight months of every year.— *Gentleman's Magazine.*

Southern Pine.—The *Times-Democrat* has called attention more than once to the fact that the Southern yellow pine is rapidly growing into favor in the North and West. The fact is now recognized that it must supply the deficiency in the Western lumber supply, and that it can well do this. Until of recent years such Southern pine as has been shipped North has been sent by way of experiment. Its value for flooring, for railroad cars, etc., was then recognized, and it was imported, although still in limited quantities. But its uses have gradually extended from year to year, and the demand for it increased.

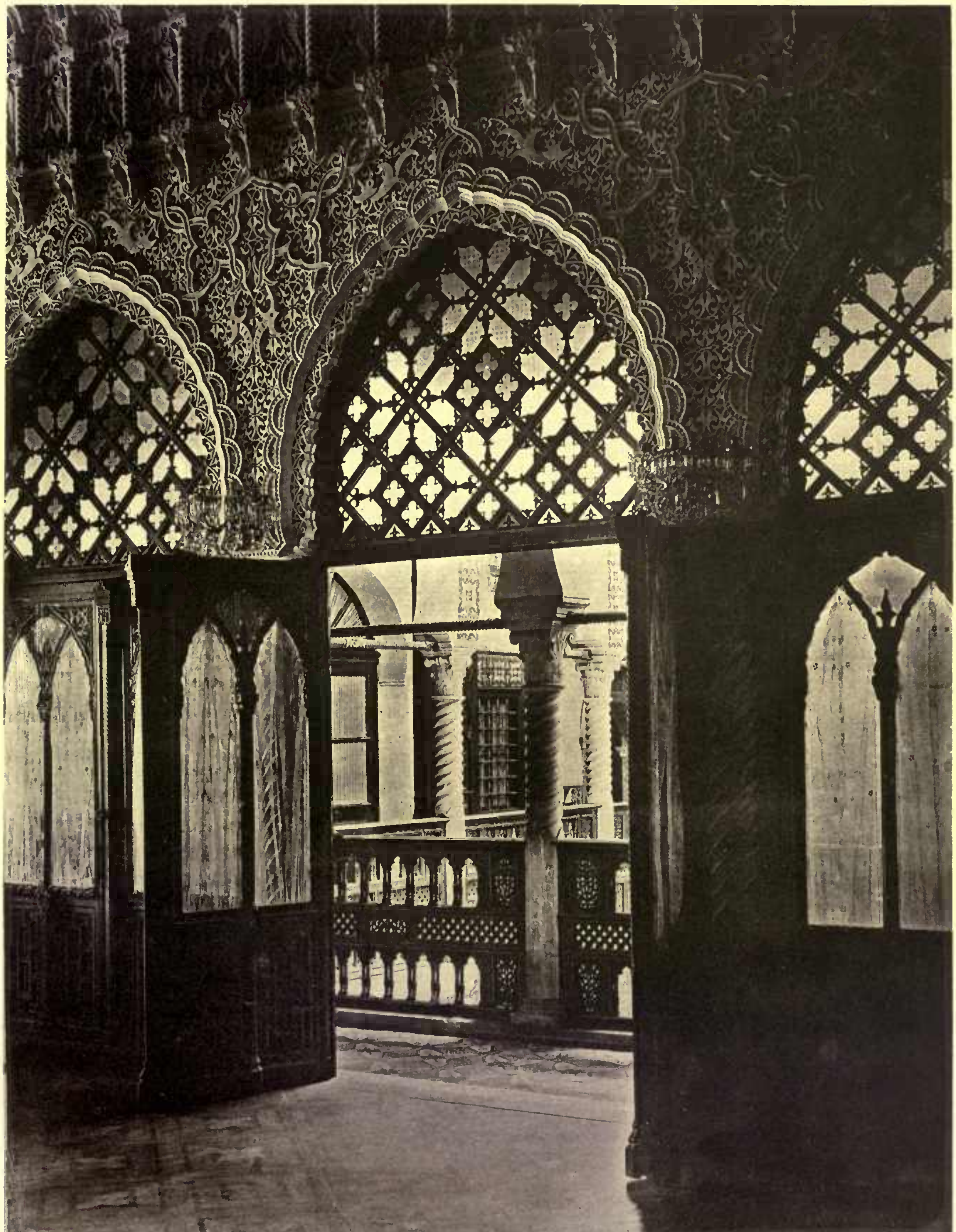
The Chicago *Lumberman* calls attention to the fact that the new elevator at Duluth, Minn., on the shores of Lake Superior, and the most northern point in the State, in the very centre of a heavily-timbered country, is being built of Southern pine from Mississippi and Louisiana. Although the lumber has to be carried by rail 1,200 miles, it is still found the best and cheapest for this purpose. In Chicago, also, the most important lumber market of the world, the largest warehouse yet built there is under construction of Southern pine, it being the strongest and best timber for heavy edifices. These facts bear evidence of the value of this Southern timber. If it can compete with the product of Michigan and Minnesota to-day, while their forests yet remain, what must be its superiority, what its value, when the country will be compelled to depend almost wholly upon the South for its lumber?—*New Orleans Times-Democrat.*

TRADE SURVEYS

Rather contradictory statements are made by architects and builders concerning the reliability of much of the statistical matter compiled on building operations. Second-class reporters are often entrusted with the delicate work of summing-up, from various disconnected sources, the aggregate of work done in many of our large cities. In some, the work is done correctly; in others, not. The general results are on the right side. The impulse given to enterprise has not been exhausted. Already a fresh impulse is gathering in fresh railroad construction. Since June 1, eleven thousand miles of railroad, according to railroad journals, have been projected. Borrowers have been, and now are, negotiating for large loans in financial centres for three thousand miles of road. There is a stronger tendency to borrow money to build railroads now than since 1882. Large blocks of idle capital have been awaiting a reviving confidence. Even before the improving returns fully justify it, capital is manifesting a readiness to again venture in the dangerous fields it retreated from so disastrously. The receivers have not yet completed their railroad-hospital work before new schemes are looming up. If half the money asked for is loaned, a boom of moderate proportions will be precipitated next spring in railroad construction. Several outside mills are now engaged on rolling imported blooms, and three more in Pennsylvania will be at work on rail-blooms in a few days. There are inquiries in manufacturers' and brokers' hands this week for one hundred thousand tons of steel rails. Within the next thirty days the locomotive-builders will have orders for over one hundred additional locomotives, and already the car-builders are refusing orders for delivery inside of ninety days. The textile-manufacturers are piling up orders steadily, and in some quarters an era of slightly higher prices is predicted. Carpet, cloth, hosiery and cotton-goods mills are pretty well crowded. Labor is causing some trouble both North and South. Wages have an upward tendency. Wool is advancing, but during the current week sales have fallen off in consequence. Lumber has sold freely at all Atlantic ports, notwithstanding the chronic depression trade reporters write about. The only just cause of complaint among lumbermen is that they are doing a large business for a small return. The builders of general and special machinery are accumulating orders for the winter. Recent improvements have rendered considerable displacements of older makes and styles necessary, and this helps to explain the general activity among machinists. A score or more of machinery-making firms of national reputation have stated, within a few days, that their prospects have never been as gratifying. Providence, Taunton, Philadelphia, Pittsburgh, Alliance, South Bend, Indianapolis, Moline, Chicago, and more Western machinery centres, are crowded with urgent work. This favorable condition is not temporary. The agents of machinery manufacturers and of machinery supply-houses are quite unanimous in the opinion that the foundations are well laid for an increasing business. The planing-mill and wood-working machinery interests are also oversold, though to a less extent than iron and machinery interests. The builders of the New England States are fairly busy on work of a jobbing or retail character. Building operations in New York City foot up $41,000,000 in value. In Philadelphia the greatest activity prevails. In Pittsburgh new work is coming out. In Chicago a large amount of work is on hand, but comparatively few large business buildings are projected. Small dwellings will be built, as the demand is still urgent. The greatest interest is exhibited in suburban houses. Architects are busy on this class of work. Real estate is active in St. Louis. Architects have excellent prospects, and will have a busy season up to the close of the year. Building activity is more general in smaller towns and cities, where real estate is selling at better prices than last year. The architects are generally pleased with the indications for the season. A fresh impetus may be imparted during the autumn season. The abundance of money is a favorable feature. Banks in the West are well supplied, and are filling all demands for funds. When the withheld enterprise of the first half of the year is freed the low range of prices for raw material will disappear.

The industries are waiting for an excuse to precipitate over-production. The expansion of productive capacity that has been quietly going on for years will produce results of an unfavorable character sooner or later. The evil is not near at hand. Railroad building on an extensive scale next year will carry us a year or two longer. The outflow of population to new States will help to postpone the reaction. Wise legislation will also help to preserve the industrial vigor which has been attained during the past eight years. But there is a tendency beneath and behind all these favorable symptoms to a reaction and depression which we have not, as yet, the wisdom to avoid or the commerical organization to control.

The labor movements of the knights and the trades-unionists are all directed to more perfect organization. In some of the Western States the wage-workers are seeking to inaugurate political action. In the Eastern and Middle States opinion is pretty evenly divided. The active workers, taking counsel from experience, are advising against political agitation, and point out that the only true and permanent progress is through education and organization. Strikes are rare. The eastern Pennsylvania iron-workers have been asked to strike, and probably will do so. The glass-workers will resume work September 1-15 on satisfactory schedules. The coal-miners will organize a National District Assembly, and the Knights of Labor will divide the work of adjusting strikes between the States, so that each State organization will be independent.



HELIOTYPE P'T'G CO., BOSTON.

GALLERY IN THE GOVERNOR'S WINTER PALACE, ALGIERS.

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WE have from time to time given somewhat lengthy accounts of the progress of the movement toward erecting a battle-monument at Bennington, Vt., because the manner in which those who were unselfishly taking a great deal of trouble in the matter seemed to us so much more intelligently directed than is usually the case, and we thought it only proper to practise what we preach, and give them as much encouragement as we could. More than this, we have more than once abstained from criticizing with severity some of the steps taken, which seemed to be in direct opposition to the principles which we had been given to understand had been adopted by the ruling minds amongst the Monument Association. It may be remembered that a year ago we spoke of the design for the monument which had been accepted, and based on the description of the design which was published in the daily prints, some rather approbatory comments on the manner in which the designer seemed to have treated a hackneyed type in a rather more architectural fashion than is usual. When, some months afterwards, we saw a small photograph of the accepted design, we regretted that we had not spoken more guardedly, or rather, had not made our remarks abstract rather than concrete. The design showed an obelisk-like shaft, crowned by an indescribable feature, a semi-Gothic pyramidion, if there be such a thing, while about the base on one side was a structure which corresponded closely to the huddle of engine-room and machine-shop that we usually find about the base of a water-works stand-pipe. To speak plainly, we were disappointed that so much apparently well-directed effort should not promise to produce a better result. It seemed clear to us that a structure of this kind in an isolated and rugged position, with nothing to give it scale, bade fair to be weak and ineffective. Still the die seemed to have been cast, and nothing more was to be said. Lately, however, steps have been taken to begin the work of erection, and it has been voted to put in a foundation for a monument three hundred feet high (the accepted design showed a shaft of this height), but it is said to be expressly understood that the Association reserves to itself the right to "improve on the design, till it reaches and passes the spot where improvement is impossible." This is a wide reservation, and may mean little in the way of change or it may mean much. At any rate it seems to place the unfortunate designer completely at the mercy of the Association, though at the same time it relieves him of some of the odium of failure, if that should chance to be the outcome of these associated efforts. The Association professes that it has not accepted a definite design, and intends to improve on whatever one may actually be begun, yet it is ready to use a portion of its laboriously-collected funds for a foundation for "a monument three hundred feet high." To us the facts that the foundation suitable for a monument three hundred feet high is not suitable for a monument of any other dimensions, and that any change of design after the foundation is laid must inevitably create the alternatives, waste through excess of strength, or danger of failure for want of it, are of grave importance. If the one designer fitted above all others for the work has been discovered—as certainly should have been the result of so much time, care and research—he is the one man in the world whose design should not be "improved" after work has begun. Once work has begun, the less a designer is interfered with, the better the finished work—usually.

A VERY curious sociological, as well as artistic question presents itself in the steps that are being taken to call a convention of the colored people at Philadelphia, to take measures for securing the erection in Washington of a million dollars' worth of statues and monuments to the memory of the white men who strove so nobly to secure their freedom — to Brown, Phillips, Garrison, Sumner, Lincoln, and others. It would be a singular revelation of the real value of emancipation from servitude, if it should be discovered that within thirty years of receiving their freedom the colored people of this country could raise a million dollars for this purpose before the city of New York could raise a similar sum to build its memorial to General Grant. As to the effect on the city of a million dollars' worth of bronze or stone images of those who first hailed the negro as man and brother, we cannot form any opinion, as it is not said whether, like contracts under a party government, the jobs would not be given to "outsiders," that is, to white sculptors; but as we know of but one colored sculptor, and that one a woman, we do not believe that the matter of race will determine the selection of the sculptor. If it is found possible to raise the money, we think it possible that we might learn another lesson from these unsophisticated but grateful brothers, who, acknowledging their own ignorance of matters of art, might yet have the intelligence to seek out the best men, and place the jobs unreservedly in their hands, so that the result might be the acquisition of a number of really good statues such as could not possibly have been erected under the mischievous interference of the usual white art-committee. As to the possibility of raising this sum or any large sum for such a purpose, M. de Lesseps has again and again showed what a mine of accessible wealth lies hoarded in the stocking-feet of the laboring classes, and it is just possible that the barefooted southern negro may have some corresponding storage place. The negro is grateful, imaginative and generous, and it is quite possible that the sum named could be raised easily and rapidly if an appeal could reach the different individuals without delay or the expense of a personal canvas.

MR. WILLIAM WHITE, F. S. A., delivered a lecture recently before the Architectural Association, upon the brick towers of Bologna, particularly the famous Asinelli and Garisenda towers, which seems from the *Builder's* account to have contained a great deal of interesting and valuable matter. Considered as works of architectural art, Mr. White treated them, as it seems to us, very judiciously, neither exhibiting his rhetoric in ridiculous rhapsodies over qualities which no one except himself ever saw in them, nor condemning them, like some modern critics, as being altogether destitute of design. The fact is, just as Mr. White says, that the lower portion of the Bologna towers, like those of Siena, Florence, and a dozen other places, were intended to rise from the midst of a cluster of lofty houses, crowded along dark and narrow streets, where anything like detail would be thrown away, and as a natural consequence the lower portion was made solid, but plain, as befitted both the situation and the purpose of the structure, while the top, which was visible for a long distance around, was treated with singular effectiveness, as well as sobriety. There are no deep mouldings, as Mr. White says, no startling or difficult projections of string-courses or cornices, but the horizontal divisions are sufficiently marked, in some cases by the external offsets which the Italians use so cleverly, and the upper story is usually distinguished by some surface decoration, which, without breaking the simplicity of outline of the tower, gives to

it all the richness which an object of the kind, intended to be seen from a distance, ought to have.

SOME time, when the artistic history of tower-building comes to be written, there will, we imagine, be found to be a curious relationship between the treatment of the mediæval Italian towers, and those built by the Moors at nearly the same period, of which the Giralda at Seville is perhaps the best-known example, and, although its upper story is a Renaissance restoration, undoubtedly shows almost unchanged the profile and general treatment of the original. The Moorish towers are very unlike those of Italy, having the upper portion of their square shafts covered with a diaper decoration in low relief, in moulded brick, while the upper story is very much broken in outline; but the Moorish towers are very high, and the same instinct which led the architect of the Siena market tower, for instance, to band his belfry-story with colored stone, instead of chopping it up with string-courses and projections, induced the Moors to cover the upper half of the shaft of the Giralda with beautiful surface ornament only, while the belfry, three hundred feet from the ground, on which surface ornament would be nearly lost, was given by its silhouette that richness which the Italian, in his smaller building, could get by color, heightened, perhaps, by the simple change from square to octagon, which two or three of the towers present, or by the rich cornice which is found in many others.

A CURIOUS question aroused by the study of the Bologna towers, both of which lean somewhat from the vertical, is whether the movement has proceeded from the yielding of the foundation or of the soil. It is probable that the yielding of the soil is responsible for it, and it would appear also that the footings must have reached, on the lower side, a hard stratum which prevented them from further sinking, and has kept them in their present position for five hundred years. At the present time, the use of concrete, the great modern material, has enabled us to overcome many of the dangers of unfavorable subsoil, but we do not know everything that is to be known about the subject, and the investigation of the construction of the Pisa and Bologna towers could not fail to be interesting and valuable. To show how many expedients occur to observant builders under such circumstances, Mr. White relates a story of one who had occasion to build a high factory chimney on a bad soil. The chimney had been built twice, and had fallen down each time, but the contractor in question, after thinking over the problem, agreed to make himself responsible for the security of the structure. The site was on the bank of a stream, and the excavation showed the ground to be of very unequal texture and resistance. It might have been possible to test each portion separately, and proportion the footings to the resistance beneath them, but this builder prepared to meet the difficulty by concentrating the weight of the chimney on as small a space as possible, so that, although it might sink, the inequality of pressure between the different portions of the base would be slight, and, being concentrated, instead of spread out in the usual form, such irregularity of pressure as might exist would have less power of dislocating the foundation. With this idea, he procured a large block of granite, which was roughly shaped into the form of a pyramid, and set in the bottom of the excavation with the point down. On the upturned base the walls were started, battering outward, until they reached the size required, and the chimney was then built upon them in the usual way. The form of the structure seems to have resembled that of an uncut cigar, stuck in the ground with the mouth-end downward, but the designer's object was attained, and, although the chimney sank eighteen inches by its own weight, the sinking was vertical, and the structure remained upright.

DURING the last year or two we have at regular intervals introduced our readers to lithographic reproductions of the works of some of the masters of architectural etching, and though these reproductions lack much of the depth and brilliancy of the original, we feel that the series has formed an interesting feature of our illustrations. It has not, however, yet included a specimen of the work of François Maxime Lalanne, who has just died at Paris at the age of fifty-nine, and who for many years held an enviable place in the ranks of French artists. As he was a frequent contributor of etchings to the *Gazette des Beaux-Arts* and to *L'Art*, his work may be familiar to those who make it a habit to associate the name of the artist with the work he produces. Although, perhaps, most successful as an etcher, he also practised successfully as a painter, lithographer and engraver, and moreover was especially skilled in handling charcoal and pen-and-ink. Of the several handbooks he wrote on the best methods of practising these arts the one on charcoal-drawing is probably best known. Among his best known original etchings are his series of "Grandes vues de Paris," and his twelve sketches taken from the bastions during the siege of Paris in 1870–1. He was honored both in his own country and abroad, receiving medals at several of the international exhibitions, and was a member of the Academies of Fine Arts of Paris, Brussels and Bordeaux.

CONSIDERING the possibilities, the introduction of the electric-light to public use has been attended by very few accidents: an occasional fire caused by an unprotected wire, a shocked horse, a fireman disabled or killed by coming in contact with a wire, or a victim of his own careless thoughtlessness, these mischances are not so often heard of as they were a year or two ago, and the fact speaks well both for the care and diligence of the employés of the electric-light companies, and for the discretion of the public. But this week has witnessed a new form of disaster with which the public can be visited by reason of the adoption of this useful system of lighting. On Monday the works of the Brush Electric Illuminating Company, on Elizabeth Street, New York, were destroyed by fire, which may have been occasioned by the electric current, by friction, or by any of the ordinary incendiary causes. The only special interest the accident has, is that because of it a large portion of the city was deprived of its nightly light. An accident to a gas-works might create as wide-spread an inconvenience, and yet could not be so easily remedied, so that the destruction of the Brush Company's large plant—forty-five dynamos, which fed twelve hundred lights, were destroyed—affords one argument in favor of the general adoption of the electric-lighting system. In a very short time connections for a large portion of the extinguished lights were made with the Company's station at Twenty-fifth Street; so if no accidents are occasioned by sending a current of unusual force over the trunk-line from this station, because of having to serve a number of lights beyond its normal capacity, the public will suffer less through the fire than through an accident of equal gravity to a gas-works.

SOME curious information is given in *Le Technologiste* about the paper bags for flour which are so extensively used in this country for retailing to the poorer classes of people. Some twenty-seven years ago a manufactory of flour-bags of cotton cloth was established in New York State. The business prospered, and the establishment had grown to be a large one, when the war broke out, and the supply of cotton cloth was soon cut off. The proprietors of the manufactory set their wits at work to find some other material of which they could make satisfactory flour-bags, and naturally thought first of paper, which had been long in use for smaller packages. No paper could, however, be found strong enough to hold the weight of the flour to be put into the bags, and the firm was obliged to begin at the beginning, and devise a new sort of paper which would be suitable for their purpose. The strongest material for paper was soon discovered to be hemp, but hemp in its natural condition was too stiff and brittle for paper-making, and it was only by various mechanical and chemical processes that it was finally subdued to the requisite pliability, and a paper was made of it which possessed immense strength, a strip three-quarters of an inch wide of the sort now used for flour-bags being capable of supporting a weight of two hundred pounds, while a strip of heavy cotton cloth of the same width will break under a load of twenty-five pounds. The bags of the new paper proved extremely popular; their sale increased from year to year, until the capacity of the establishment, to keep pace with the demand, has been extended to a production of thirty-five million bags per annum; and the firm, to supply its material, carries on three paper-mills, which produce twenty thousand pounds of paper a day from old manilla ropes, brought from New York by boat. The bags are made by machines, which roll the paper into long tubes, paste the seams, cut the tubes into lengths, and fold the lower edges, ready to receive the bottom piece, which is pasted on by hand.

STROLLS ABOUT MEXICO.[1] — XIII.

A DAY IN TEXCOCO.



The Fountain, Texcoco.

IT was an early hour on an October morning when we set out for a trip to Texcoco, and a sharp chill filled the air, for it is usually chilly in the City of Mexico until the sun is well above the low-lying mists that brood over the valley levels, and are settled down in the thin atmosphere. It was a long way from the plaza out to the station, and we sat shivering in the street-car, with empty stomachs, for the cafés had not opened their doors. We shivered still as we sat in the train waiting for it to start, but we made the best of it, for we knew it would be warm enough before long, and to lug around overcoats all day would be a nuisance outweighing our temporary discomfort. It was a narrow-gauge railway under native management, and the cars were shabby beside the handsome equipages of the Central and National Railways. There were but two classes, and we sat uneasily upon the hard wooden seats of the first-class coach, and as we watched the peons crowding into the second-class, we almost wished that we had followed the temptation to join them, for in their cars there were open sides, and the seats consisted of transverse benches, as in our open street-cars, giving a jaunty, picnic-like appearance. The train started at seven o'clock, and the sharp draught that obliged us to shut the open window promptly relieved us of any remnant of a longing for a change that we had cherished. Frozen to death in the tropics, might have been the verdict, otherwise, and all enlarged enjoyment of the landscape would soon have been turned to mourning. We crossed the desolate flats that were formerly covered by the lake, and which merged in that dreary sheet so gradually that we could hardly see where the shallow waters began to stretch away on their expanse of twenty miles or more. The monotony of the region might have made it a good subject for an illustration of Hades, were it not for the nobility of the near mountains which we were rapidly approaching; the two magnificent great volcanoes gleaming in snow-crowned royalty, splendid in the early sunlight, which threw grey shadows over their hither slopes. We reached Texcoco at half-past nine o'clock, and knowing it to be the headquarters of that division of the railway, we recognized the place by the fact that as we slackened speed in approaching the station, we passed a number of crippled locomotives awaiting opportunity to enter the repair-shop, like patients about the door of a charity hospital.

Among the expectant crowd at the station, we selected a comely lad, slender and straight—an Indian, of course—as guide and luggage-carrier. A gleam of white teeth lit up his brown face as he answered "Ignacio," in response to our question as to his name, and took charge of the camera, handing the tripod over to an urchin, whose brown skin showed through the scanty rags which played over it, as clouds play above the earth. Mexican-like, Ignacio had engaged this boy to help him, for a Mexican servant will, if possible, hire a servant of his own to lighten his labors.

"Now, Nacho; *a la fonda para desayuno*" (to the restaurant for breakfast), and we were guided down a handsome broad avenue, leading into the city, and lined with rows of the bunchy little trees with formally-trimmed crowns, much affected in Mexico, and more decorative than shade-giving. The plain-fronted houses, mostly of one-story, had an affluent look, with beautiful court-yards visible through open doors and, often, spacious gardens in the rear, and we were told that they were the homes of "*altos particulares*," or "exalted individuals," which formal bit of Castilian seemed quite applicable to what we felt inclined to accept as the nobility of the realm of Nezahualcoyotl, the rival of proud Moctezuma, whose capital Texcoco was. Texcoco seemed to have that indescribable, yet very definite air of intense respectability often maintained by small old cities in the neighborhood of great capitals, whose rivals they are in age and historic glories, though long since overshadowed in importance. Texcoco had been in railway communication with the neighboring capital of the republic but two or three years, and though a prosperous place, the seat of some manufactures, including a very profitable glass-factory, it still seemed to slumber in a restful atmosphere, little disturbed by the affairs of the world at large. It struck me as a kind of Mexican Salem, and I was not surprised that it, also, had its "institutions," one of which was an academy for the study of the old Nahuatl tongue, the language of the Aztecs.

Ignacio led us around a corner to the principal hotel of the place, and an admirably kept one it was, the proprietor being a Frenchman, a shining example of the Bonifacial talents of his race. Refreshed with a *desayuno* of coffee and rolls, both excellent, we sallied forth to see what we could see. We found the Zócolo, or central garden of the city, unlike most places of the kind, occupying the midst of the main plaza, but it was a walled enclosure adjoining the market-house. Hardly so well kept as usual, it had a charm of quiet neglect, with its tangled shrubbery and flowers, amid which stood some fine old idols carved in stone. Near by was the parochial church of San Francisco, a magnificent old edifice with some peculiarities which gave it a decided architectural individuality, most notable among them was the portico, with its finely-proportioned large and small arches. An old crone appeared from somewhere, and showed us through the church, and out into a little *campo santo* with walls dazzling in a coating of fresh whitewash, and the usual hideously tasteless tombstones, which, for some reason I have failed to discover, are in all Latin countries the most tawdry and unpicturesque objects to be found. The old lumber-room through which we passed, was, however, a treasury of *bric-à-brac;* dusty old ecclesiastical paintings, and a miscellany of wooden carvings of saints and angels, heavily gilded and richly painted, all piled in confused heaps. Those representing the afflictions of martyrdom had the customary horror-inspiring features which recalled to me the amusement that I once derived from the consternation with which a good Puritanical New England lady fled from a similar lumber-room in an old German church, into which I had inadvertently led her, while showing her the lions of the place.

We clambered to the tower, and the hour which we spent there, basking in the sunshine and drinking in the beauties of the landscape, will always linger as a happy memory. The large lake was just far enough away to give it the enchantment of distance; wholly a thing of beauty. Away across on the other side rose the towers of the great city, which, lying so low, seemed to rise glittering from the blue *lago* like Venice from the lagoon; above towered the dark, lofty wall of the Sierra de la Cruz, over which was lifted the gleam of one snowy peak, the Nevado de Toluca, which was invisible from the capital. There was a particularly fine view of the two great volcanoes; a characterization, however, which seems to apply to almost every sight of those mountains when beheld from a new standpoint. "Where is Texcotzingo?" we asked, and Ignacio pointed out to us a cone-shaped hill a few hundred feet high rising four or five miles away to the eastward, and overshadowed by a mountain-range at whose feet it stood. So that was the site of the famous country palace of Nezahualcoyotl, enchantingly described in Prescott, and, I fear, unintentionally somewhat exaggeratedly! But we did our best to fancy it still occupied, with terraced sides splendid with sculpture, flowers, and sparkling fountains, and all the luxuries at the command of barbaric magnificence. We did not have time to visit the hill, but a friend who had been there was eloquent over the beauty of the site and the view, though he said there was nothing to tell of what it had been except a few fragments of sculpture. We found no difficulty in distinguishing the site of Nezahualcoyotl's town palace in the shape of a huge mound, which, we were told, had been standing but little disturbed up to within a few months, when it had been largely demolished to make room for certain improvements.



Chapel Doorway, Texcoco.

The superincumbent palace had been destroyed in the early days of the Conquest. The church from which we looked was, among other buildings, constructed of its stones, the sculptured faces of which, it is said, were turned inward in the walls. We visited the spot when we left the church. It was but a few streets away, but we found nothing of interest in the shapeless heap of small stones and gravel.

Truly, Texcoco was a goodly kingdom and fair to look upon, we thought, as we still stood in the belfry and gazed over the glorious landscape. It was not difficult, after all, to fancy it a "kingdom,"

[1] Continued from Vol. XIX, No. 546, page 285.

as kingdoms went in olden days, for, in my school years, I had gained a rather small idea of the domains of the classic monarchs about whose incessant squabbles and depredations I read in ancient history, and my boyish standard of comparison for the relative importance of their territories lay in the various vacant lots, cow-pastures, huckleberry-patches and corn-fields about the town, which I proceeded to designate mentally as Macedonia, Thessaly, Sparta, etc. I think the insignificant showing made by Greece on the map of Europe helped me to this estimate. So, when iconoclastic archæologists proceeded to strip Prescott's Mexico of its romantic glamour and degrade its mighty empire and plucky kingdoms to Indian districts, its massively-built capital cities to huge pueblos, its monarchs to chiefs and sachems, I took out my revenge in applying the same standards to classic antiquity, including the Iliad and its events. Indeed, it does not seem as if the notable researches of Schliemann revealed a state of things much superior to that of the reign of Moctezuma.

Descending to earth again, we resumed our stroll about town. A plain little chapel standing by itself in the church-yard had one feature of interest in the shape of an elaborately sculptured doorway, highly Rococo, and flanked by two queer angels, each with a palm branch. These branches had the effect of huge quill pens with which they proposed to inscribe the records of the sinners who passed below.

Another interesting architectural feature was a fountain at a street corner; a structure with walls rising as high as the adjacent houses; two large archways giving access to the huge basin within. Above was a copy of the ancient Roman statue, the Tiber. The open terra-cotta work of the coping is a common feature of architecture in Mexico, giving a light, aerial elegance to the sky-line of an ornate structure.

Though the glories of Texcotzingo have departed, it might be said that they have not flown far, for there is a delightful rural paradise near by in the shape of the garden of the Molino de Flores. It was Sunday, and when we visited the only livery stable in the city we found that all the teams were employed. Carriages are scarce in quiet Texcoco, and none was to be had, so we decided to walk. Although the sunshine poured down ardently, we did not regret our decision, for it was a pleasant stroll of a league or so through the maguey fields, the ground gradually rising until we gained an extended prospect back toward the city. When well out of town we paused to rest and refresh ourselves with a large package of delicious fruit, bought in the market-place.

We saw nothing of our destination until we reached the summit of the rise and viewed the road winding down toward an *arroyo*, or ravine, the upper part of which was brimming with a stream of leafage winding out of the hills above. We soon descended and came to a stone bridge beyond which were the buildings of the place; a village of the employés' cottages on irregular terraces along the steep sides of the ravine. We entered through a paved court where there was something of a bustle of peons, donkeys, and mules. Beyond rose a chapel dome and the mill buildings were visible through an arch, under which we passed and obtained entrance to the garden by the formality of an application at the counting-room. Could a mill in our own country be imagined surrounded by such loveliness? The owner was a wealthy Spaniard, Señor Cervantes, a gentleman of fine taste and a passion for rural beauty, as his work here showed. Water gushed wildly out from passages under the massive buildings, and tumbled, rushed, and rippled in various moods on all sides, coursing through the garden in mossy channels, its babbling echoing all around like naiad voices. The order was perfect, and though it was well along in the dry season, the grass was fresh and green, sprinkled from hose attached to inconspicuous hydrants at frequent intervals. The paths wound around among the trees into charming nooks. The grass was starred with sweet violets which filled the autumn air with springtime fragrance. The solitude was that of a mountain glen. The wild stream of clear water, fed by the perpetually melting snows of Ixtaccihuatl, came rushing down its steep descent in many cascades. Fortress-like retaining-walls bordered the stream, and a bridge crossed to a mortuary chapel on the other side, the spick-and-span newness of which seemed hardly in keeping with its surroundings.

We whiled away the mid-day in the garden, and were so refreshed that the walk back to the town brought no fatigue.

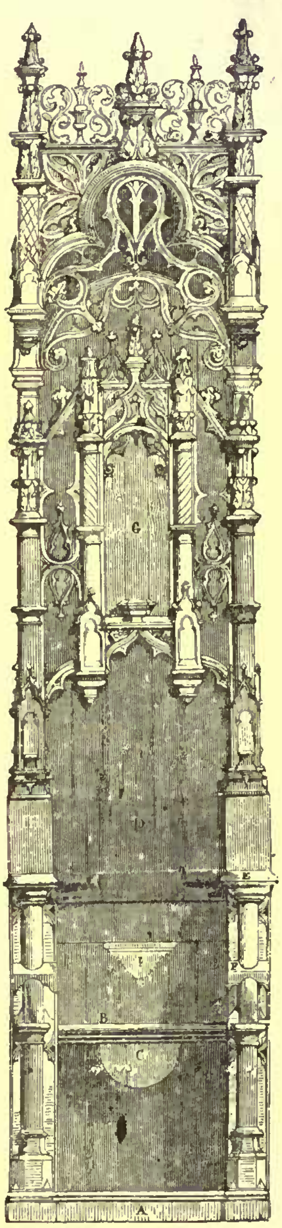
On our return by train to the capital we tried the open second-class cars, and, in spite of the dust which almost smothered us, enjoyed the unhindered views. The last sight of the snowy volcanoes, roseate with Alpine glow against the eastern purple as we drew near the city at nightfall, was alone enough of a reward.

Sylvester Baxter.

An Ancient American Pavement. — A party of land prospectors recently came upon some ancient works in this county. They first found what appeared to be the ruins of an old well, walled up with stones, in which a moderate supply of cold water was found. They removed the stones, which had caved in, to a depth of about three feet. Further examination revealed the fact that the ground around was regularly paved with stones for at least an acre, varying from three feet deep in the centre to a foot at the outer edges. The stones are covered with moss, which may be rolled up like a blanket, disclosing the stone as clean as if water-washed. The country about is timbered, and trees two feet in diameter are growing above the ruins, while the forms of a prior generation of trees even larger lie in moss and decay at their feet and above the ruins also.— *Shawano (Wis.) Journal.*

AN EDITOR'S TRIP ABROAD.—IX.[1]

SWISS CHALETS AND CHURCHES. — THE RUSSIAN CHAPEL AT GENEVA. — THE DUKE OF BRUNSWICK'S TOMB.— CHURCHES.



Choir Stall in the Church at Brou.

There is a fascination about an inhabited and fertile valley in the midst of high mountains, which it is difficult to resist, and one must, it seems to me, live a long time in Switzerland before he can sufficiently separate the architecture of the country from its surroundings to be able to criticize it intelligently. For the ordinary tourist it is perhaps enough to remember that, according to Viollet-le-Duc, who spent his summers there for many years, and was thoroughly familiar with the subject, the Swiss construction in wood, such as is now mostly seen in the German-speaking part of the country, is essentially the same as that practised by the Aryan ancestors of the Indo-European races, in their original home in the Himalayas. Their descendants either colonized or conquered the Swiss valleys, together with the rest of Europe, and he thinks that in these secluded portions of the world there has been little change in the methods of building for five or six thousand years, and perhaps much longer. Five thousand years is a long time for the duration of an architectural fashion, but one can easily believe that Viollet-le-Duc is right. Some years ago I came across a half-finished house in what was then a rather unfrequented valley in the Bernese Alps. The walls, built of hewn logs, halved together in the ordinary Swiss manner, were nearly done, and the timbers for the roof were on the ground. These were roughly carved at the outer ends into heads of different shapes, and were notched and dovetailed so as to frame together perfectly, with pins at the joints. When these were on, nothing would remain, to complete the house in the usual way, but to lay horizontal poles over the rafters, with pieces of bark on these, lapping like shingles, and more poles on top, holding down the whole by the rows of stones so familiar to every one in Swiss houses. The window-sashes would, it is true, need iron hinges, but with the exception of these, which may be conceded to be a modern innovation, and are dispensed with in the humble sort of buildings, there was nothing in the construction of the house that could not have been executed without the use of metal, and one can easily believe that an intelligent barbarian, with tools consisting of flints tied to sticks, and with plenty of time on his hands for ornamenting his dwelling, might not only frame his house with the same sort of notching and dovetailing, but would carve it all over with just the sort of Polynesian decoration that nearly covers, even at the present day, so many of the old buildings about Interlaken and Brienz.

Although hundreds of these ornamented houses still exist, it seemed to me this year that their number had diminished, while the houses which were taking the place of the old ones were of a very different character. There were plenty of brand-new châlets, with scroll-work in conspicuous positions on the outside, but one band, of gigantic proportions, was often made to cover the space which in an old house would be occupied by four or five bands of different design, and while the old work was invariably carved on the solid piece, the new sculpture was in most cases evidently sawed out of a thin veneer, and tacked on with little nails. Even the old houses themselves, where fire and decay had spared them, were rapidly being metamorphosed by the fatal process of shingling into objects which, if still picturesque, gave no hint of the beauties which lay concealed beneath their scaly covering. Like the rest of us, the Swiss prefer to be warm in winter, and there is no doubt of the fact that squared timbers, laid simply edge to edge, and subjected to the seasoning and warping of a century or more of sun and rain, admit an unnecessary amount of fresh air during cold weather, which can be kept out by a good triple layer of shingles, and we can hardly blame the owner of

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[1] Continued from page 74, No. 555.

a sculptured house, if, on comparing the satisfaction which he derives from the contemplation of the carving on his dwelling with that which his neighbor takes in the reduction of his bills for fuel, he decides at last to sacrifice the artistic and historical interest of his house to the comfort of his family.

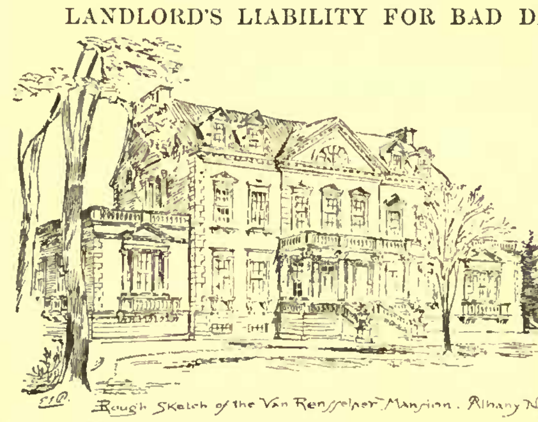
If, however, the old Swiss architecture seems likely to disappear gradually from the portions of the country most frequented by strangers, there is comfort in the reflection that some of it will be replaced by work of another sort of artistic interest. It is natural enough that the seat of a great architectural school should be distinguished by the prevalence of a good style of design, and at Zurich the good seed scattered from the Polytechnic School on the hill seems to have found an exceptionally favorable soil, and to have sprung up into a remarkable growth of well-studied, beautiful and interesting buildings. At Geneva, although the new quarter of the city contains some pretty houses, showing a cleverness and originality of treatment which was very probably due to Zurich training, the more important architectural productions of recent date are rather disappointing. Although I did not see the inside of the new theatre, the gift of the Duke of Brunswick to the city, the outside seemed to me to show a respectable acquaintance on the part of the architect with other modern theatres, and not much more; while the Brunswick Memorial, although it pleases one by the evidence it gives that the citizens were grateful enough to their benefactor to spend a good deal of money on his tomb, has little further attraction. The guide-books seem to think that they help the credit of the monument by saying that it is copied from one of the Scaliger tombs at Verona, but it is only fair to its designer to say that it is very far from being a copy of that or any other structure, and it comes perhaps as near to being either original or successful as the Albert Memorial in London, which it somewhat resembles.

The third of the newer Geneva buildings of importance that I saw was the Russian church, or rather chapel, as it is a tiny affair, only large enough to accommodate a congregation of about fifty, and owing its striking appearance, which distinguishes it at a great distance among the other buildings of the city, more to its elevated situation and the singular appearance of its twisted and gilded domes, than to its size. A Tartar church would be a novelty anywhere in Western Europe, and the architect needed only to cover his building with onion-shaped roofs and golden chains to be sure of exciting the admiration of the crowd; but apart from these the exterior, with its red and white striped walls and good detail, is pretty and interesting. Inside, one's sense of the architectural forms is lost in the richness of the decoration and furnishing. The church proper consists of little more than a square box, without columns, or even seats to furnish it, covered with a dome and preceded by a porch. A sanctuary, rather more than a semi-circle in plan, opens out of the church, but this is kept shut off except during divine service, and contains little in the way of decoration. On the side toward the auditorium, however, the doors and their frames, which are of cedar of Lebanon, are very richly sculptured, and there are pictures and other objects enough on the walls to give the whole room a curious interest. Two of the pictures, by a Russian artist whose name the sacristan could not give, interested me very much. Both of them were single figures, representing female saints or angels, with intensely Russian features, the hair almost white, the eyebrows black, and the complexion chalky, but the feeling of the artist had transfigured even these unaccustomed materials, and more beautiful or saintly figures one rarely sees painted. In contrast with the modern works were two very ancient Byzantine pictures, hideous enough to suit the most ardent antiquary, but set in frames of solid gold, lavishly ornamented with diamonds, pearls and rubies. I do not pretend to be a very good judge of the price of precious stones, but I should say that, apart from the gilding on the domes, the thickness of which I could not tell, the value of either of the frames would have paid the cost of the church, yet the sacristan exhibited them as unconcernedly as if they had been of pine wood. Without containing quite so much preciousness within a small space, the rest of the fittings of the church were equally sincere and satisfactory. The steps to the sanctuary were covered with a carpet which, although patched, was embroidered over every square inch; and, small as it was, the church gave an impression of richness far superior to that which one derives from interiors covered with the tinsel which so many saints are supposed to be unable to distinguish from solid metal.

As a rule, however, the air of mountain districts, or, perhaps, the sharpness of vision which mountain climbing promotes, seems to be unfavorable to the growth of a taste for tinsel, and the churches of all denominations in the Alpine districts are remarkably unpretending. At Domo d' Ossola was a little church which, except for the inscription over the door, dedicating it to "Mariæ Virgini ad Nives," and for a certain ecclesiastical look about the altar, would have answered very well for a Cape Cod meeting-house, and no meeting-house could have been more simple in the arrangement of the pews and pulpit. At Martigny was a rather pretty church, equally simple in its arrangement, but with a very richly-carved door, and some pretty wrought-iron work, and Chamonix also possesses a curious building of much the same character. The great Swiss cathedrals are to my mind, I must confess, rather uninteresting. They are, except that at Constance, practically French as to their construction, and the construction is the least beautiful, although not the least interesting part of a French cathedral of the thirteenth or fourteenth century, while the lovely detail, which, in France affords the architect continual pleasure, is found only in limited amount in the great Swiss churches.

Between the ecclesiastical buildings of Munich and those in the mountains there is certainly an instructive contrast. The value of incense-smoke as a factor in architectural effect had never occurred to me until I witnessed a service in the Church of St. Michael. According to the guide-book, this was built by the Jesuits, and afterwards used as the royal chapel of Bavaria, but nearly everything about the interior still retained the peculiar character of Jesuit architecture. The walls and ceilings were pure white, with the usual extravagant relief work, rather sparingly decorated with gold, and an immense reredos, something like a baldacchino flattened out, and pretty liberally gilded, rose behind the altar nearly to the roof. A picture, which seemed to have no small merit, was set in the middle of the reredos, where its effect was almost totally destroyed by the glaring white about it, and other pictures hung, like blots, on the dazzling walls. Rich as the building was, the interior seemed very crude and disappointing until the censors began to swing briskly. The first wreath of smoke changed the aspect of affairs a little, and in a few minutes the choir was transformed. The staring reredos appeared to retreat backward to a vast distance, and beyond the line of moving priests it seemed like the apparition of some heavenly structure, while the transept recesses filled with a soft blue haze, which brought the white and gold, with the shadows and "carnations" of the pictures, into tolerable harmony. As the smoke was dissipated in the intervals of the service, the raw look came back into the church, to vanish again as more incense celebrated the conclusion of the sacrifice.

LANDLORD'S LIABILITY FOR BAD DRAINS.



THE old question of the responsibility of a landlord for the defective drainage of a house which he had let to a tenant came again before the High Court in the case of Bartram *vs.* Aldous, which was the first case tried before Mr. Justice Grantham. The case is specially instructive, as the fact of the house being in an unsanitary, state was not disputed. Evidence, which was admitted to be accurate, was given to show that the waste-pipes from the bath-room opened direct into the main sewer, and that the house-drains were untrapped. The natural consequence was that sewer-gas escaped into the house, and the tenant's family became ill. Under these circumstances he refused to pay two quarters' rent which was due, and brought a counter claim for the damages which he had sustained through becoming tenant of a house which was uninhabitable.

By English law a landlord who lets a house does not ordinarily warrant that it is fit for habitation. The tenant is supposed to make inquiries, and ascertain the material facts for himself; and if he makes a bad bargain, so much the worse for him. The fact of the drains being defective, of itself, affords no answer to a claim for rent, and Mr. Aldous was obliged to rely on a representation which he alleged the landlord to have made at the time of letting the house, to the effect that the drains and water-supply were both perfect. On the question of this representation having been made there was a conflict of evidence, and the jury gave their evidence in favor of the landlord. Whether this verdict was right or not is a matter which does not concern us here. The case shows plainly that a tenant of an ordinary house cannot, *after he has made his bargain*, impose on his landlord the additional liability of providing proper drains. There are, no doubt, exceptions to this rule. It has been decided that a landlord who lets a *furnished* house, impliedly warrants that house to be fit for habitation, and that he may therefore be liable to pay damages consequent on its not being so. The Housing of the Working Classes Act of last year, 48 & 49 Vict. c. 72, sect. 12, also provides that in any contract "for letting of habitation by persons of the working classes, a house or part of a house, there shall be implied a condition that the house is at the commencement of the holding in all respects reasonably fit for human habitation." Neither the Legislature nor the judges have seen fit to incorporate any such condition into contracts for the letting of houses of a superior class, and there the intending tenant must protect himself. This he can do by having the house surveyed before he becomes tenant, when, if his surveyor is competent, any gross sanitary defects are likely to be detected. He might also insist on the insertion in his lease of a covenant by the landlord that the drains, etc., are, and shall be kept in a proper condition. Such a covenant is at present unusual, and the landlord's solicitors w uld probably for that reason object to its insertion. But if the intending tenant insisted, and the house was in

such a state as to comply with the requisition, the covenant would most likely be conceded: if the landlord's agents persisted in refusing, that fact should certainly be sufficient to raise a suspicion that the house was not altogether fit for habitation. Too often landlords let, and tenants take houses without giving any real thought as to their sanitary condition. Greater attention at the time of letting to the duties and to the risks which they respectively incur, would save many disputes and much subsequent unpleasantness, and would be beneficial to the health of the community.—*Sanitary Record.*

ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

THE ROTCH TRAVELLING SCHOLARSHIP DRAWINGS. — PLATES XXI, XXII, XXIII.

[Issued only with the Imperial edition.]

THE BAYARD BUILDING, KANSAS CITY, MO. BUILT FOR NATHANIEL THAYER, ESQ. VAN BRUNT & HOWE, ARCHITECTS, BOSTON, MASS.

THIS building has been built for business purposes on first floor and basement, with offices on floors above. Its front is of brownstone from Longmeadow, Mass., and it is supplied with all the modern requirements of office-buildings, including marble staircase, hydraulic elevator, bells, tubes, electric light, etc. It is to a great extent a pioneer in this regard in Kansas City. It will cost, completed, about $60,000.

COMPETITIVE DESIGN FOR A $5,000-HOUSE, SUBMITTED BY "*Multum in Parvo.*"

The Estimate.

Excavation,	$97.00	Windows,	$300.00
Stonework,	320.00	Blinds,	41.75
Brickwork,	345.00	Stairs,	230.00
Concreting,	70.40	Inside finish,	790.00
Heating,	180.00	Mantels,	58.00
Plumbing (including drain-pipe and gas-fitting),	256.00	Plastering,	322.00
Cellar windows,	26.00	Painting,	350.00
Frame, covering and furring,	912.00	Roofing,	180.00
Trimmings,	295.00	Miscellaneous,	56.85
Outside wall finish,	170.00		$5,000.00

HOUSE OF LYMAN C. JOSEPHS, ESQ., NEWPORT, R. I. MR. C. S. LUCE, ARCHITECT, NEW YORK, N. Y.

HOUSE OF J. G. DARLINGTON, ESQ., HAVERFORD, PA. MR. R. G. KENNEDY, ARCHITECT, PHILADELPHIA, PA.

COMPETITIVE DESIGNS FOR A $5,000-HOUSE, SUBMITTED BY "*St. Lys*" and "*Ingomar.*"

AMERICAN ARCHITECT COMPETITION FOR HOUSE COSTING $5,000.—VI.[1]

"*ST. LYS.*"—Plan fairly good. Waste room in hall. Details good as far as they go. General mass and conception of exterior very good; symmetrical and simple. Lacks belt-course on line of second floors; also lacks sufficient projection to eaves. If gambrel could be of slightly less breadth, thus making it more nearly in scale with the gables, it would be better. Rendering lacks shadow.

"*Ingomar.*"—The plan under this title calls for the most severe condemnation possible. To deliberately invent awkwardly-shaped rooms when they are not required by the problem is a sure sign of absolute ignorance of good planning. Beside being expensive to build, awkward to furnish, such rooms are never satisfactory in appearance, and it is impossible to roof such a plan and make an exterior that will be good from all points of view. The first essential of good planning is to get symmetrical rooms opening *en suite*, and, as far as possible, this rule should be applied even to a small country house. Details: The ledge at top of stone underpinning would catch snow, which would melt and back into room. *Papier-maché* will hardly do for exterior use, even as a hinge or clamp where none is needed. Floor beams usually cut on to ledgers, and rafters on to plates. Boarding usually covers joint between stone underpinning and sill, where no water-table is used. Placing plate as shown on piazza posts would look very badly, and the plate is much too thin and would not support the rafters.

"*Two Dromios.*"—Plan ordinarily good. Waste space in hall. Details fairly good. Exterior: a very badly-proportioned gambrel. Proportion of bays to wall-surface, poor. Walls too high. Piazza cornice poor; square bay very poor indeed. Rendering needs study.

"*Dovercourt.*"—The study not well placed. Interior details very poor, especially staircase balusters. Exterior poor. Piazza posts too high. Bad method of finishing sides of hoods. Panels of rough-cast plastering are not ornamental. If plaster is used outside, it should be used in large surfaces, well proportioned, or not at all. Perhaps not at all would be the better advice at present. Rendering needs more free-hand work.

"*Sunset Lodge.*"—Waste room in hall; otherwise plan is very good. Novelist is isolated in an ingenious fashion. The whole design has a capital scheme of plan and of masses of exterior, with some few exceptions, but lacks skill in detail and in sense of proportion. The long veranda is very effective, but it is doubtful whether a gambrel should be put over it. The problem of terminating the lower slope of gambrel on east side at once comes up, and seems to necessitate throwing gambrel farther over to the west, or changing it to a pitched roof and getting head-room, where needed, by dormers. This latter method would probably be the better one. The dormers on rear would be better with pitched roofs. The lack of cornice and rake mouldings makes house seem uninteresting, and the rendering of the perspective, which is very poor, does not at all do the design justice. It has the making of an excellent house in it.

"*Lawn Tennis.*"—Library opens too near kitchen; otherwise plan is ordinarily good. Details are angular and stiff. Constructive details good. Design is not well proportioned; too little roof for wall; too slight projection to rakes. Looks boxy. Too many small panes of glass, diminishing the scale of windows that are already too small for the amount of wall-space. Rendering of details good; of perspective labored and spotty.

[1] Continued from page 74, No. 555.

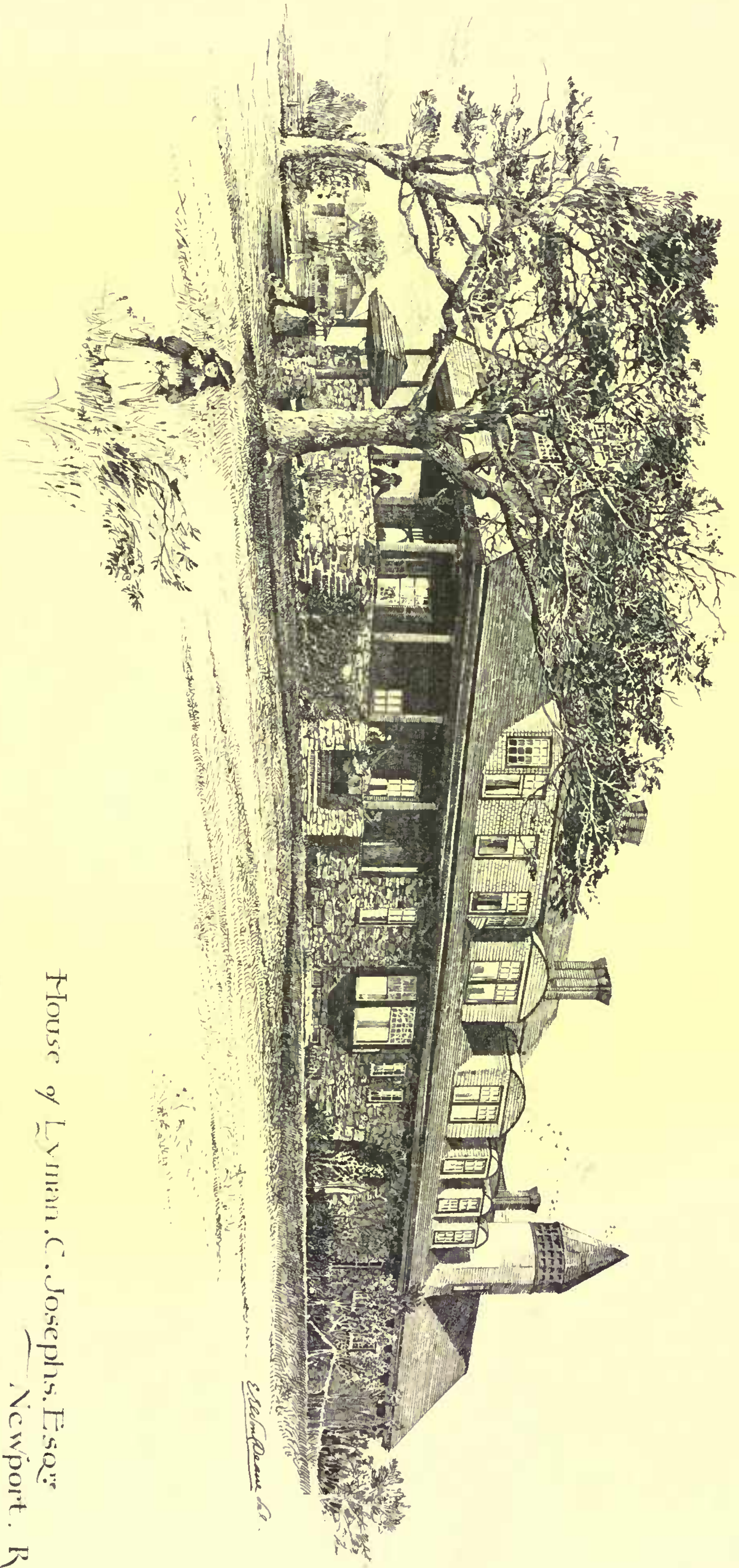
PICTURES OF THE SEASON IN NEW YORK.[1]—VII.



TOWER OF OLD CHURCH. WESTON FAVELL, ENG.
AFTER SKETCH BY THOS. GARRATT. A.A. SKETCH BOOK, LONDON

TURNING now from the portraits to the landscapes in the current exhibition of the Society of American Artists at the Metropolitan Museum, we find them fewer in number than we might perhaps have expected, but by no means lacking in interest. The tendency of many of our younger men to give themselves up largely to reminiscences of foreign lands, even when working here at home, has never shown itself so strongly — for very obvious reasons — in their landscapes as in their work with the figure. And this year we seem to see a distinct advance toward entire independence. American subjects are more numerous than ever, and in many cases are interpreted with a sympathetic truth which a few years ago was the rarest of qualities. I mean that a few years ago, even when a landscape was American in name it was too often French or Dutch in aspect — that while the artist's corporeal eye had been resting upon some local scene, his mental eye had been remembering foreign scenes and the manner of their interpretation by foreign brushes. Doubtless he was quite unconscious of the fact, and desired nothing so much as to be absolutely true to the special task he had set himself. But habits of eye and hand are stubborn things; and we have much reason to be thankful that so many of our young graduates of European schools have now succeeded in learning how to make American landscape themes "artistic" on canvas and yet not make them un-American. A singularly attractive example of this power is to be found in the work of Mr. Tryon. When his name first appeared in our catalogues it was associated with pictures that were excellent in many ways, but, I think, distinctly transatlantic in flavor. They always had the precious quality we call sentiment, but this sentiment apparently did not find itself quite at home amid our local materials. But year after year he has devoted himself to the study of American landscape under many aspects, and to-day has grown into a painter than whom it would be hard to imagine one more wholly in sympathy with his subjects. His technical ability has steadily improved as well, and he has wholly worked out of a certain undue softness and lack of vitality and variety in texture which once characterized his results, without losing the tenderness and individuality of color which they always possessed. To say that he has sentiment means, of course, that his work is poetical as compared with that which aims merely at giving the bare outer truths of nature. And few more poetical landscapes of wholly and distinctly American aspect have been granted us than his "Moorlands — Dartmouth" in the present exhibition. It shows a broad stretch of flat but rugged land, most characteristically truthful and yet most artistic in composition. The moisture-laden atmosphere is admirably palpable and visible, and the somewhat low scale of color does not at all degenerate into monochromatic dulness. And it should be noted as a great

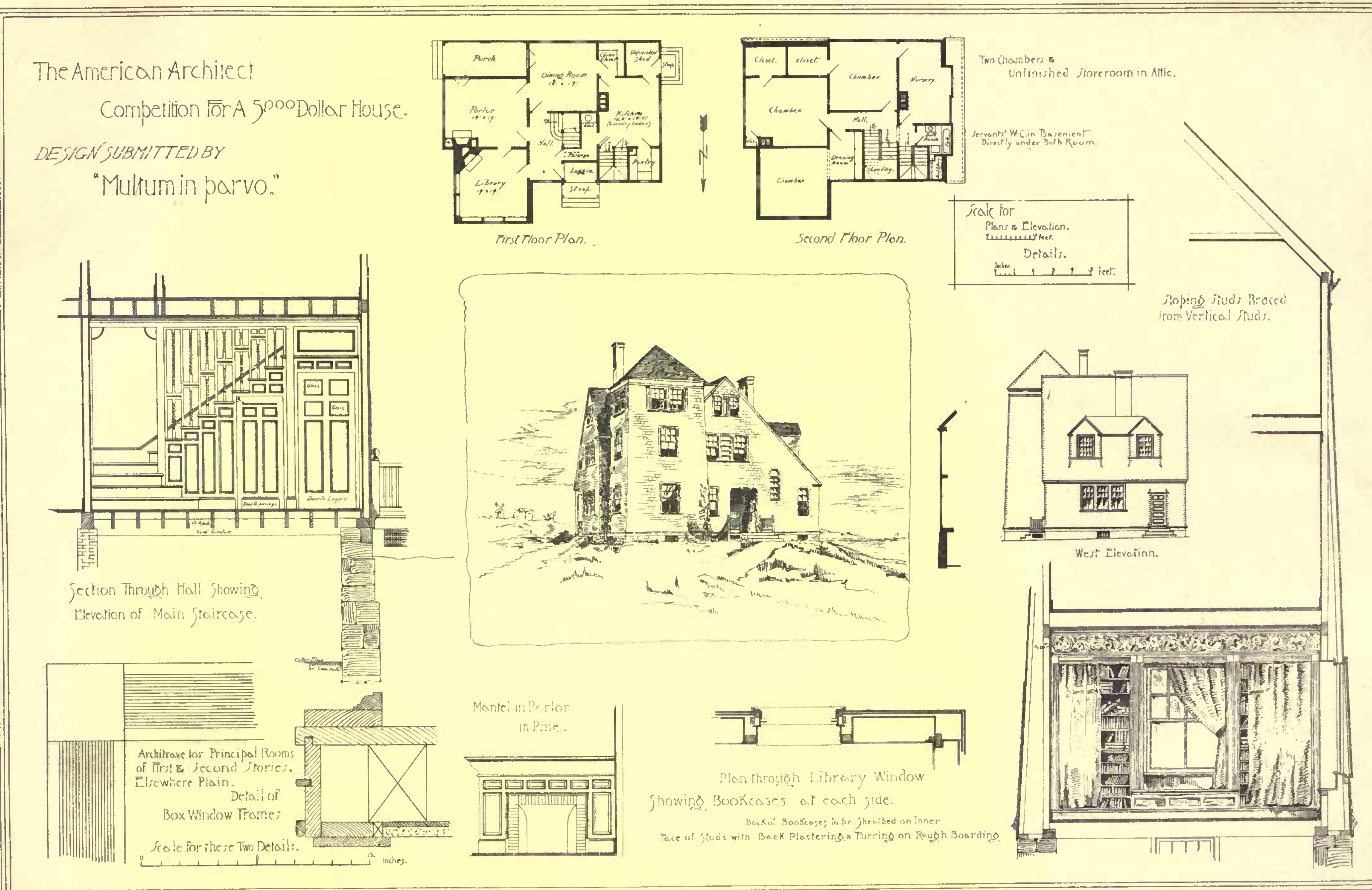
[1] Continued from page 43, No. 552.



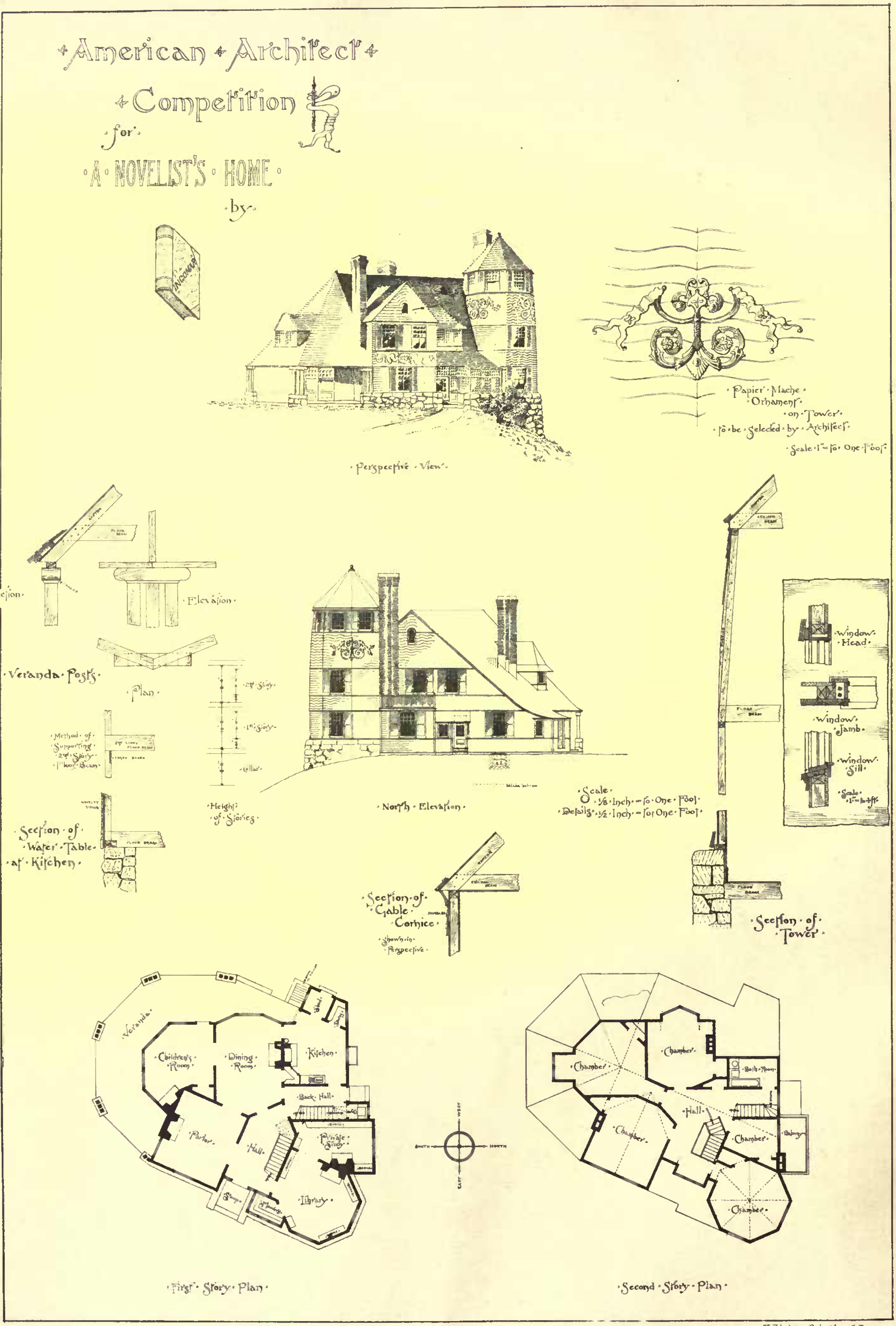
House of Lyman C. Josephs, Esqr. Newport. R.I.

Mr C. S. Luce. Archt N.Y.

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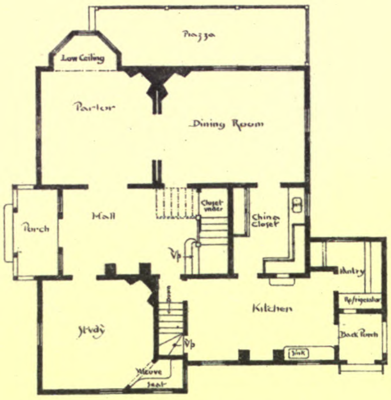


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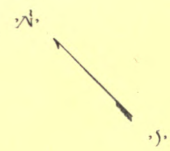


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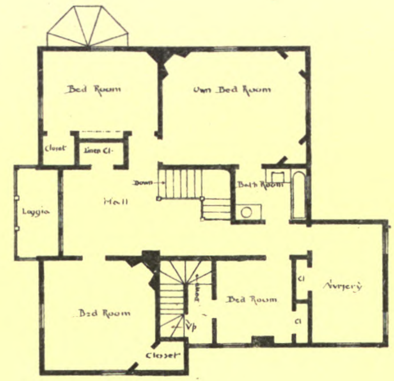
AMERICAN ARCHITECT AND BUILDING NEWS, AUG. 21 1886. No. 556



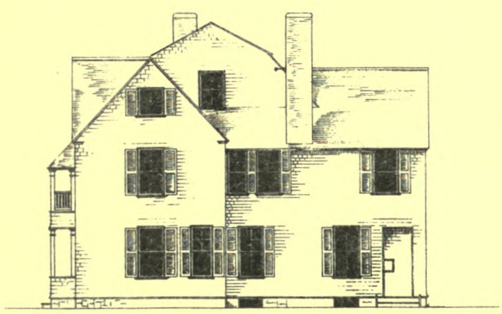
First Story Plan



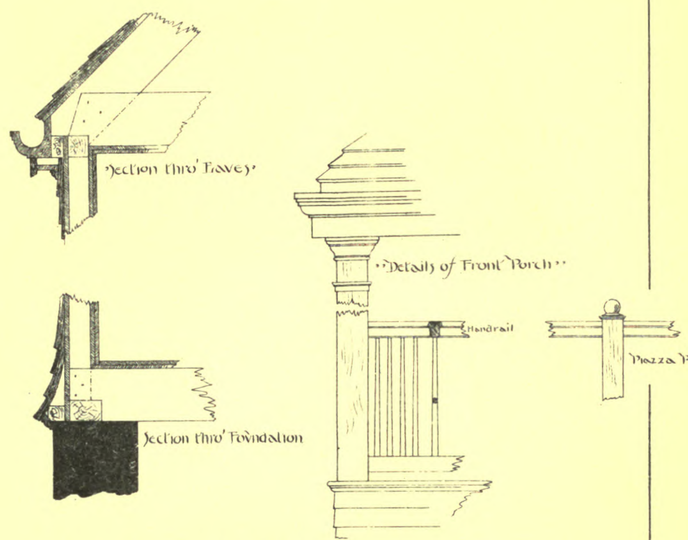
Plans & Elevation to ⅛ Inch Scale



Second Story Plan



South West Elevation



Details to Inch Scale

$5000.00 House Competion for "The American Architect"



ST. LYS

Heliotype Printing Co Boston.



Heliotype Printing Co. Boston.

virtue that neither here nor in his other canvases, so far as I have seen them, does Mr. Tryon shirk the "Americanism" of his theme by omitting all evidence of the presence of man. Certainly our bare, square, little rural homes are not so attractive to the eye as the cottages of the old world; but nevertheless they are *here*, and if one essays to paint the land he must paint them, too, or confess to artistic cowardice. And, after all, they are by no means unpaintable, if a man has not an ordinary eye but the eye of a true artist. Certainly they are satisfactory enough under Mr. Tryon's touch. See, for example, his second picture in this exhibition — a very small moonlit canvas with a flock of sheep and a little bare farm-house on the top of the low hill-side up which they are straggling. It is the simplest bit of New England nature and life that one could well imagine, yet as poetical in this transcript as though it had been a bit of Barbizon itself. And if we examine it attentively we see that its charm springs largely from its very unlikeness to any foreign scene. The clear, dark, vital blue of the sky is very different from the moonlit skies of northern Europe, and the truly American fact that the little house is white, has given the artist the happiest of his details. It is a capital bit of work, and a charming idyl, too: he who cannot find poetic suggestiveness in this cool, clear, placid night, and in the single lighted window of the humble dwelling, is, I am afraid, neither a good judge of art nor a good citizen of the Great Republic. So often, by the way, is moonlight travestied upon canvas, so seldom is it painted, as here, without exaggeration and without shortcoming, that it is to be hoped this will not be by any means Mr. Tryon's last experiment in the same direction.

Mr. Ryder's "Moonlight," on the other hand, does not seem to me a piece of poetized truth so much as a piece of imagination pure and simple. As such it has—for it is Mr. Ryder's,—a distinct value of its own, though inferior, in my judgment, to very many of its forerunners. Mr. Walter Palmer's "River Shore" is interesting, and so are Mr. Evans's landscape, Mr. Charles Warren Eaton's "November and Twilight," Mr. Kenyon Cox's "Oat-field," Mr. Coffin's "Hayfield and Afternoon," and Mr. Alexander's large "impressionist" study of a rocky New England pasture. Mr. Kost's "Evening at Clifton, Staten Island," is individual and simple and shows a successful desire to deal with the greens of nature when they are very blue. Mr. Allen's "Berkshire Pastoral" addresses itself with good results, on the other hand, to the days when our foliage has lost its greens altogether and taken on the difficult harmonies of autumn. Among a number of good landscapes with foreign subject-matter I need only note, perhaps, some delightful studies by Miss Amanda Brewster and Mr. Hitchcock's "Garden of Dutch Bulbs." The latter is rather a union of two themes than a single homogeneous conception, for the delicately toned and handled leafy background "falls away" to a regrettable degree from the foreground. But each part is nice in itself and the foreground is especially interesting just at this moment by reason of its proof that the vivid and sharply contrasted tints of a great tulip-bed may be painted more harmoniously than in Gérôme's picture in the Morgan collection, and yet with as much truth to the facts of local color. Miss Brewster's studies deal with the thrice-familiar features of the level French country, yet have a distinct individuality of their own—a fact which speaks well for the vitality and value of her talent. They are very pale and delicate in tone yet full of color and of atmosphere; show much feeling for composition, even when the theme is of the very simplest; and have to my eye a most attractive and poetic flavor.

Among the figure-paintings proper the most striking are certainly those signed by Mr. Kenyon Cox. One, called "Evening," shows the life-size nude figure of a nymph who is stretching herself to sleep in the midst of a wooded landscape under a sunset sky. I suppose nymph is the accepted term in such a case though it hardly seems very representative here, in such different fashion from this are the average nymphs of current art conceived. For this is no bloodless abstraction, no classicizing nonentity, but a very handsome, very healthy, very superb specimen of femininity—one who would be characterized by the simple term woman better than by any other. To say this is in itself high praise, and it is higher still to add that although it is a strongly sensuous impression we first receive from the figure, it is not at all a sensual impression. If she is not an abstract nobody, neither is she simply an undressed model. There is very good color, it seems to me, in the flesh and the general scheme is strong and rich. The design of the landscape—with its broad, open foreground stretch and heavily-massed foliage in the background has a very desirable accent of dignity as well as charm, and the whole impression the picture gives speaks more of nobility, less of triviality or commonplace than is often the case in similar works. The drawing of the figure itself is in general very graceful and vigorous, though there is a lack of grace in the pose of the right arm which supports the reclining figure. With regard to correctness of drawing, I shall not venture to speak — for I have learned by long experience that this is a matter where, unless incorrectness is of a very patent sort or correctness proves itself beyond all question and all cavil, it is far safer and far juster for a layman to refrain from judgment. The artist who had his model before him, is much more likely to have reproduced correctly than we to imagine correctly: and in almost every case there is too much divergence in the verdicts of criticizing brother-artists for even their words to be taken as gospel. The only fault I shall venture to find with the work is with regard to a little matter of taste. It does not seem as though in Arcadia, when the only other draperies needed are soft airs and the sheltering mantle of light, a nymph would want an outstretched piece of white linen to lie upon. But its whiteness is certainly welcome and effective as an element in the general scheme of color. Unfortunately Mr. Cox's other and kindred essay called a "Vision of Moonrise" is by no means so satisfactory. It shows the same commendable love of pure sensuous beauty, and the landscape background has again much individuality and charm. But otherwise the composition — two figures and a vividly ruddy moon—falls very far short of the desired effect alike with the eye and with the mind.

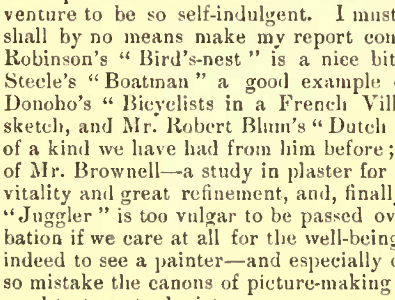
Mr. Francis Jones's "On the White Sand Dunes" shows a clump of low gnarled trees growing out of snowy sand with a glimpse of the sea beyond—a characteristically American, and also a very difficult theme which has been treated with great success and much beauty of effect. There is no imitation of foreign prototypes, yet almost any French painter of the *plein air* might be content to have done as well—to have been as true to his exacting local colors, yet to have kept his tonality so good, to have given so much truth of form and suggestion of detail and yet to have kept his effect so airy and and luminous and so deliciously fresh. The two girls' figures beneath the trees are well conceived and executed, but it is the landscape — or, more truly, the picture as a whole—which we like best to praise.

Mr. Brush adheres as ever (and very wisely), to his themes of Indian life. His "Before the Battle," showing a line of braves taking a last inspiration from the lips of a witch-like old woman, has good qualities of dramatic and other kinds, but, as painting proper, is somewhat hard, uninteresting and lacking in charm. Miss Chadwick's "Girl picking Water-Lilies" is simple and straight-forward, and seems to be commendably American in subject although its author dates, in the catalogue, from Paris.

In no exhibition could Mr. La Farge's work seem other than remarkable. Here we have a life-size water-color figure, called "The Lamp-Bearer," which is to be classed rather as decorative than as strictly representative art, yet is lovely and vital in type as well as mysteriously enchanting in color; and a number of exquisite little flower-studies among which a "Water-Lily in Sunlight" is perhaps the most inimitably delicious. In the exhibition itself it is pleasant to keep this for a *bonne-bouche* as we leave; but on paper I cannot venture to be so self-indulgent. I must add — though even thus I shall by no means make my report complete — that Mr. Theodore Robinson's "Bird's-nest" is a nice bit of French work and Mr. Steele's "Boatman" a good example of south-German; that Mr. Donoho's "Bicyclists in a French Village," is an attractive little sketch, and Mr. Robert Blum's "Dutch Interior," another good work of a kind we have had from him before; that Mr. Warner's portrait of Mr. Brownell—a study in plaster for a bust in bronze—has great vitality and great refinement, and, finally, that Mr. Francis Miller's "Juggler" is too vulgar to be passed over without a word of reprobation if we care at all for the well-being of our art. It is mournful indeed to see a painter—and especially one who has a clever hand—so mistake the canons of picture-making as well as those of universal good taste as to depict a young woman poising herself upon some acrobatic instrument, and poising another upon her nose. This, however, is the only example of distinct bad taste in the exhibition—the only one which shows the working of Parisian influence in its very worst shape. On the whole, the collection is extremely encouraging from whatever point of view we may regard it. "All good things," says a German proverb, "are in threes"—and the qualities of this collection prove the fact. For it shows, first, that our new men have attained to a greater mastery of color, as distinguished from tone, than they revealed in the beginning of their course; secondly, that they have become more American, alike in their choice of themes and in their manner of treating them; and thirdly, that they have grown to care more for meaning, feeling, sentiment, idea and less exclusively (which is not to say *less*, be it noted) for technical success.

M. G. van Rensselaer.

PIPING FOR NATURAL GAS.



FONT NOW IN THE CRYPT OF CHARTRES CATHEDRAL.

The fire-marshal of Pittsburgh, Pennsylvania, has, at the instance of the Board of Fire Underwriters, issued the following rules for gas-fitters, to be followed when laying-on natural gas:

"All pipes must be tested by the gas company's inspector with mercury column to ten pounds pressure, from end of line where connection is made to end of pipes under grates, stoves, etc.

"The fitter should have his pump on and see that the pipes are perfectly tight before sending for the inspector.

"The ends of pipes under grates, stoves, etc., should first be capped, so as to allow the stop-cocks to be tested; then remove the caps and see if the cocks allow the gas to leak.

"In case the mercury drops, a test for leak by putting ether in the pump, or with soap-water will be made.

"In no case shall a fire-test be used in dwellings, offices, stores, etc. No cement of any kind shall be used for repairing faulty fittings or work; nor is the use of blind gaskets permissible.

"When any attempt to hide leaks is made, the name of the fitter will be kept on record in this office, and future work done by him will not be approved without rigid examination.

"In running pipes in buildings no set rules can be given, except that pipes must, in all cases when possible, be so placed that they can be easily inspected; and that in case of accident any leaking gas may escape easily.

"Cement wall carefully where service-pipe enters the building, and use a large pipe for the main that runs through the cellar. Provide valves to shut off gas from all risers. In running pipes through flues great care is necessary, and lead pipe for the bends should not be used.

"Do not run between floors or walls when any other method can be employed. Do not place cocks between floors or ceilings. Do not use any valves which require packing at the stem in places where leaking gas may be dangerous. If pipes run outside of walls, provide a drip.

"Allow plenty of air under grates, so that the hearth-stone may not get too hot. Set the back tile in the grate so that the unburnt gases will be directed up the chimney, and not allowed to enter the room.

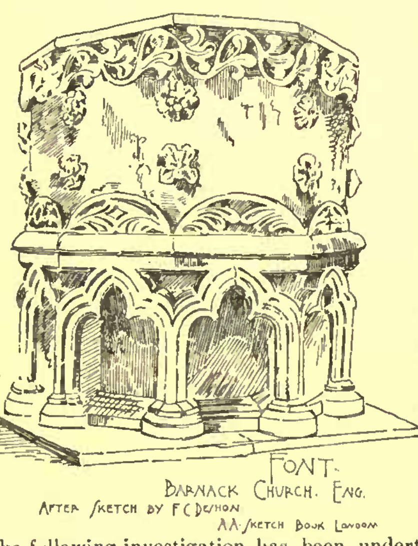
"By admitting more air under the grate, so that it will percolate through or between the hot bars in grate, results in a cheerful, bright fire from bottom of grate to the top of the fittings, and also in front

"In fitting up a building, all gas-fitters will be required to furnish the gas company, who are to supply the fuel, with a statement giving the number of fires fitted up, and also any additional fires that may be connected afterward in the same building, so that a complete record may be had at this office. Blank forms for this purpose will be furnished by the different companies supplying natural gas.

"It should be borne in mind that a leak of natural gas is not so perceptible as of artificial gas, on account of the very slight odor arising from it; and more care should be taken in piping a building for its use.

"Fitters should also remember that accidents and explosions are likely to occur through defects in fittings and pipes; and as the introduction of natural gas is a benefit to the fitters, the community at large, and to the insurance companies, the fitters should do all in their power to make the use of natural gas as safe as possible; and they can materially aid in this by endeavoring to put in pipes and fittings in a perfect manner."

ON THE RELATIVE ECONOMY OF VENTILATION BY HEATED CHIMNEYS AND VENTILATION BY FANS.[1]



OF the various modes of producing the air currents by which vitiated air is removed from chambers, halls or working places, and fresh or pure air simultaneously introduced, involving the processes of ventilation, the heated chimney is the most common; although it is generally recognized that where large volumes of air are to be moved against considerable passive or frictional resistance, the use of the fan or blower is theoretically the most economical.

The following investigation has been undertaken with a view of establishing the exact theoretical relation between these two modes of ventilation, as far as economy of heat is concerned, and incidentally to determine, as far as the uncertain elements of the question may permit, the circumstances under which either of these methods may advantageously be employed in preference to the other; it being understood that the ventilation of public buildings, mines, suites of rooms, or single large rooms are all included in the problem.

It is assumed that since air is everywhere present at the earth's surface, ordinary ventilation is accomplished by a single movement of air, all portions of which exist under the same pressure before motion begins, and that therefore the problem does not involve the lifting of the air through a determined height. The resistance to motion, or the forces to be overcome, are then the frictional resistances of the passages through which the air flows, and the inertia of the air put in motion. The expression frictional resistances is to be understood as implying all those resistances which oppose or obstruct the motions of fluids through conduits or channels, and which are usually expressed in terms of the height due to the actual velocity of flow, or are proportional to the square of the actual velocity of flow.

The work per second necessary to overcome these resistances may be expressed by the weight which flows per second multiplied by the head or height of a column of fluid which, expressed in terms of the velocity of flow, represents the total resistances. The frictional head for a given condition of things — a given conduit and passages — is usually expressed by a constant depending on the length, form and dimensions of the conduit and passages, multiplied by the head due to the velocity of flow; or by an expression having the form

$$F\frac{v^2}{2g}.$$

The work performed in putting a weight of air represented by w in motion with a velocity v per second will be therefore

$$W = w\frac{v^2}{2g}(1 + F).$$

If there are no resistances except those due to the inertia of the moving masses of air the constant quantity F disappears, and the work will be that represented by $w\frac{v^2}{2g}$ —the living force or actual energy imparted to the air per second.

In any investigation having for its object the relative economy of the methods of putting the same quantity of air in movement per second, through the same channels, and with the same velocity, it will be sufficient therefore to consider the work $w\frac{v^2}{2g}$, since the work performed per second in both cases must be the same whether the frictional resistances are considered or not.

It is further to be remarked, that by whatever means air is put in motion under the circumstances which we are considering, the process consists in a reduction of pressure at one point, whether a fan or a heated chimney be used, which creates an unbalanced head in the surrounding air, and a consequent flow to the point of reduced pressure.

This unbalanced pressure per square foot of section produced by a heated chimney is represented by the expression:

(1.) $$p = H.(D_a - D_c),$$

in which H represents the height of the chimney, D_a the weight per cubic foot of the external air, and D_c the weight per cubic foot of chimney air.

The height of a column of fluid, whether of chimney air, external air, water or mercury, which would represent this pressure is found by dividing the above value of p by the density of the fluid; thus,

(2.) $$\frac{P}{D_c} = H\left(\frac{D_a - D_c}{D_c}\right) = H\left(\frac{T_c - T_a}{T_a}\right), \text{ because } \frac{D_a}{D_c} = \frac{T_c}{T_a}.$$

T_c and T_a representing the absolute temperatures of the chimney air and the external air respectively.

In this last expression $H\left(\frac{T_c - T_a}{T_a}\right)$ represents the height of a column of air of a uniform density D_c, which by its weight would give a pressure per square foot represented by P.

The velocity with which air would flow into a space under this pressure is

(3.) $$v = \sqrt{2gH.\left(\frac{T_c - T_a}{T_a}\right)}.$$

The work per second produced by the chimney for each square foot of cross-section will be

(4.) $$W = pv = D_c v.\, H\left(\frac{T_c - T_a}{T_a}\right).$$

Substituting the value of v from (3) we have

(5.) $$W = D_c\sqrt{2g\,H^3.\left(\frac{T_c - T_a}{T_a}\right)^3} \quad . \quad . \quad . \quad \text{foot lbs.}$$

This is the work per second in foot-pounds accomplished by the expenditure of heat in heating the air of the chimney, and thus producing motion.

The quantity of heat thus expended is represented by the expression

(6.) $$Q = D_c v.\, c_p(T_c - T_a),$$

in which Q is expressed in units of heat, $D_c v$ represents the weight of air which passes through each square foot of cross-section per second, and $(T_c - T_a)$ the number of degrees through which this air has been heated, and c_p the specific heat of air under constant pressure.

If we substitute again in this expression the value of v taken from (3) we have

(7.) $$Q = D_c c_p\sqrt{2g\,H\frac{(T_c - T_a)^3}{T_a}}.$$

This expression represents the heat units expended in heating the air of the chimney to produce the velocity v in the chimney.

The heat furnished may be supplied by a furnace at the base of the chimney, the heated products of combustion from which mingle with the air which enters the base of the chimney; by a system of steam-pipes which heat the air by contact as it passes through or among them, or by any other mode which will accomplish the result. If a fire or furnace be employed, as in mines, in such a way that the dissipation or loss of heat from the furnace is prevented, the efficiency of the furnace may be considered unity.

Under this, the most favorable circumstance for the efficiency of the chimney, equation (7) gives the total heat generated and available.

In ventilation by a fan or blower driven by a steam-engine, the heat expended to produce the same velocity, or the same discharge

[1] A paper by Prof. W. P. Trowbridge, read before the American Society of Mechanical Engineers, Chicago Meeting, May, 1886.

and renewal of air, will depend on the efficiency of the steam boiler and engine, the efficiency of the fan or blower, and the loss by friction in the apparatus.

If we consider the efficiency of the boiler and engine to be one-tenth, the efficiency of the fan five-tenths, and the loss from friction two-tenths, or the efficiency as regards friction eight-tenths, the resulting efficiency of the whole apparatus will be

$$E = .1 \times .5 \times .8 = .04 \text{ or } \tfrac{1}{25}$$

The work performed by the heated chimney to produce the velocity v, and for each square foot of cross-section was found to be equation (5)

$$(8.) \qquad \overline{W} = D_c \sqrt{2g H^3 \left(\frac{T_c - T_a}{T_a}\right)^3} \quad . \; . \; . \text{ in foot lbs.}$$

To produce the same work by a fan whose efficiency is $\frac{1}{25}$, twenty-five times this amount of work must be expended in equivalent heat units. Hence the number of heat units to be expended will be

$$(9.) \qquad Q^1 = \frac{25}{772} D_c \sqrt{2g H^3 \left(\frac{T_c - T_a}{T_a}\right)^3},$$

the second member being divided by 772 to transform its value in foot lbs., to its value in heat units. The relative quantities of heat expended by the chimney and fan, or the relative efficiency under the conditions assumed will then be

$$(10.) \qquad \frac{Q^1}{Q} = \frac{\frac{25}{772} D_c \sqrt{2g H^3 \left(\frac{T_c - T_a}{T_a}\right)^3}}{D_c c_p \sqrt{2g H. \; \frac{(T_c - T_a)^3}{T_a}}}.$$

$$\text{Or} \qquad \frac{Q^1}{Q} = \frac{25 H}{772. \, c_p T_a} = \frac{H}{7.35 \, T_a},$$

the value of c_p being 0.238.

If we suppose the temperature of the external air to be 60° Fahrenheit, the value of T_a will be 519.4, and

$$(11.) \qquad \frac{Q^1}{Q} = \frac{H}{3817.59}.$$

This expression shows that the relative efficiency depends only on the height of the chimney, and in no way on the differences of temperatures within and without the chimney. For a chimney one hundred feet high the efficiencies will be as 1 to 38.17; or,

$$Q^1 = \frac{Q}{38.17},$$

showing that the chimney requires an expenditure of heat thirty-eight times greater than the fan. For a chimney five hundred feet high, the fan will be 7.6 more efficient.

If the chimney be heated by steam-pipes at its base the efficiency of the boiler and pipes must be taken into consideration, making a result still more unfavorable for the chimney.

On the other hand, where small quantities of air are moved, requiring only a fraction of a horse-power, or one or two horse-powers, to drive a fan, these powers being produced by a small engine and boiler employed solely for this purpose, the efficiency of the mechanical apparatus would probably be much less than $\frac{1}{25}$, a condition of things unfavorable to the fan.

We may now inquire under what circumstances the chimney might be advantageously employed instead of the fan.

In all cases of moderate ventilation of rooms or buildings where as a condition of health or comfort the air must be heated before it enters the rooms, and spontaneous ventilation is produced by the passage of this heated air upwards through vertical flues, the efficiency of this mode of ventilation is evidently unity; that is to say, no special heat is required for ventilation; and *if such ventilation be sufficient*, the process is faultless as far as cost is concerned. This is a condition of things which may be realized in most dwelling-houses, and in many halls, school-rooms and public buildings, provided inlet and outlet flues of ample cross-section be provided, and the heated air be properly distributed.

If, starting from this condition of things, we suppose a more active ventilation to be demanded, but such as requires the smallest amount of power, the cost of this power, when the wages of a skilled mechanic are taken into account, may quite outweigh the advantages of the fan in fuel. There are many cases in which steam-pipes in the base of a chimney, requiring absolutely no care or attention, may be preferable to mechanical ventilation, on the ground of cost, and trouble of attendance, repairs and maintenance. There is quite a wide field for the employment of heated chimneys for ventilation before a limit is reached when the fan becomes indispensable, even when economy alone is considered; and this field becomes more extended, when convenience, saving of time, and personal care and attention influence a choice.

Ventilation by chimneys is disadvantageous under one point of view in any case, viz.: the difficulty of accelerating the ventilation at will when larger quantities of air are needed in emergencies.

The fan or blower possesses the advantage in this respect that by increasing the number of revolutions of the fan the head or pressure is increased, the law being that the total head produced is equal (in centrifugal fans) to twice the height due to the velocity of the extremities of the blades, or

$$H = \frac{v'^2}{g} \text{ approximately in practice.}$$

In mines it is evident that to produce by a chimney the same ventilation as that produced by a fan with the same economy of fuel the up-cast shaft must be very deep. Taking into consideration the wages of an engineer employed to run a large fan and the cost of maintenance and repairs, it might happen, however, that a mine of moderate depth, where the galleries are large and the resistances consequently small, could be efficiently ventilated by a furnace and chimney, at no greater expense than is required for the fan.

It is worth while to consider in this connection the rate at which the expenditure of heat increases in chimney ventilation when for the same channels of flow it is desirable to accelerate the velocity by increasing the heat of the chimney. Equation (3) gives the volume of flow per unit of section of the chimney, in terms of the height of the chimney, and the interior and exterior temperatures. For the same height H, the volume of flow per second is proportional to the square root of the difference of temperatures.

Equation (7) gives the expenditure of heat for the same height H, and for the same difference of temperatures. The height H remaining constant, the expenditure of heat is proportional to the square root of the cube of the difference of temperatures.

The first formula is equivalent to the following:

$$V = C \sqrt{T_c - T_a},$$

and the second to

$$Q = C' \sqrt{(T_c - T_a)^3}$$

C and C' being constants.

If in these formulas we make $(T_c - T_a)$ successively, 9, 16, 25, 36, 49, 64, 81, we have the following results:

Differences of Temperature.	Volumes.	Heat expended.	Differences of Temperature.	Volumes.	Heat expended.
9°	C × 3	C′ × 27	49°	C × 7	C′ × 343
16°	C × 4	C′ × 64	64°	C × 8	C′ × 512
25°	C × 5	C′ × 125	81°	C × 9	C′ × 729
36°	C × 6	C′ × 216			

This shows that as the volume (or velocity) is increased by increasing the difference of temperature, the expenditure or heat increases as the cubes of the volumes.

Economy of heat requires, therefore, that the *velocity* shall be kept small and increase of *volume* obtained by enlarging the chimney and the channels or conduits through which the air passes. Moreover, since the resistances from friction diminish in rapid proportion as the channels are enlarged, and more of the total head produced by the chimney becomes available to create the velocity of flow, an additional advantage in large cross-sections for the chimney and conduits is secured.

The same laws of expenditure of heat hold for the fan or blower, the expenditures of heat increasing for the same conduit as the cube of the velocity of flow. This is, in fact, a general law for all cases where work is performed under such circumstances that the resistances are proportional to the square of the velocity of motion. In such cases the resistance being ($R = C. V^2$) a constant multiplied by the square of the velocity, the work performed per second will be proportional to the cube of the velocity

$$\overline{W} = Rv = C V^3.$$

It often happens that for a particular chimney and channels of flow the ventilation becomes insufficient, and instead of increasing the heat in the chimney with a large additional expenditure of fuel, a fan is introduced to take the place of the chimney ventilation. The relative efficiency $= Q \frac{Q^1 H}{3817.59}$, and the application of this law of the proportion of heat expended to the velocity of discharge enables us to ascertain to what limit such a substitution of a fan for a chimney may be carried before the cost of the fan exceeds the cost of the furnace ventilation.

In the above equation of efficiency, if the chimney is one hundred feet high the fan will be thirty-eight times more efficient than the chimney, and the table shows that the velocity of flow by the fan may be quadrupled before the cost exceeds that of the chimney. If the chimney is two hundred feet high the fan will be nineteen times more efficient than the chimney, and the velocity of flow may be increased to a little more than two-and-a-half times that which was produced by the chimney before the cost by the fan exceeds that by the chimney. For a chimney five hundred feet high the velocity by a substituted fan could hardly be made twice that produced by the chimney before the cost of the fan with increased ventilation should exceed that of the chimney. The question might then turn upon the advisability of getting the increase by additional heat in the chimney even with a large proportional additional expenditure of fuel; the cost of attending and maintaining the fan becoming an important element in the problem.

It is quite evident that for the fan as well as for the chimney low velocities and large conduits are favorable to economy.

The following records of experiments are furnished in connection

with this paper as a contribution from Mr. George A. Suter, M.E., a graduate of the School of Mines, junior member of the Society, and now engineer for the New York Exhaust Ventilator Company.

Record of Experiments made with the Blackman Fan by Mr. Geo. A. Suter, M. E., to determine the volumes of air delivered under various conditions, and the power required.

Revolutions per minute.	Cubic feet of air delivered per minute.	Horse-Power.	Water-gauge. Inches.	Nature of the experiments.
350	25797	0.65		Drawing air through 30 feet of 48 inch diameter pipe on inlet side of the fan.
440	32575	2.29		
534	41929	4.42		
612	47756	7.41		
340	20372	0.76		Forcing air through 30 feet of 48 inch diameter pipe on outlet side of the fan.
453	26660	1.99		
536	31649	3.86		
627	36543	6.47		
340	9983	1.12	0.28	Drawing air through 30 feet of 48 inch pipe on inlet side of the fan—the pipe being obstructed by a diaphragm of cheese-cloth.
430	13017	3.17	0.47	
534	17018	6.07	0.75	
570	18649	8.46	0.87	
330	8399	1.31	0.26	Forcing air through 30 ft of 48 in. pipe on outlet side of fan—the pipe being obstructed by a diaphragm of cheese-cloth.
437	10071	3.27	0.45	
516	11157	6.00	0.75	

The experiments were made by him with great care, the power of the engine driving the fan having been determined by the steam-engine indicator, and the volumes of air delivered having been carefully determined at the same time by an anemometer.

The fan employed was a Blackman fan, belonging to the class of disc fans, four feet diameter, and the experimental apparatus was so arranged that the air was drawn and forced alternately through a metallic tube thirty feet long and four feet diameter; the fan being mounted at one end of the tube.

In the first two sets of experiments the only resistance to the flow of the air was the frictional resistance of the tube and fan passages, and the resistance caused by the contracted vein at the entrance. In the second two sets the passage of the air was obstructed by a diaphragm of cheese-cloth placed within the tube; and this additional resistance was ascertained by a water-gauge in the usual way. The table of experiments is useful for determining the horse-power required for given volumes of air discharged with this class of fans, under free delivery and against resistances represented by the water-gauge readings of the table. For large volumes with free delivery, or with very small water-gauges, the efficiency and the small power required are worthy of attention. Estimating four and a-half pounds of coal per horse-power per hour in common cases, with coal at five dollars per ton, a horse-power will cost, as far as fuel is concerned, about one cent per hour; the hire of a man to take care of and manage the apparatus, including other expenses, perhaps twenty-five cents per hour.

For such cases, and especially where the power required is only a *small fraction* of a horse-power as in ventilating single large rooms, or small buildings, it is evident that as regards cost of fuel and the care and attention required, ventilation by heated chimneys is to be preferred. Where a fan is driven by machinery employed for other purposes than ventilation, the cost of attendance chargeable to ventilation being therefore trifling, the fan would evidently in all such cases be more appropriate. A variety of circumstances and conditions enter into these problems of ventilating single rooms, or halls, and a choice can only be made through the exercise of the best judgment.

Under circumstances where hospitals or public buildings of considerable magnitude are to be ventilated, and especially where the activity of the ventilation must be varied occasionally, the fan is, no doubt to be preferred. And this is quite sure to be the case when the vitiated air is drawn through several systems of collecting ducts from a series of large rooms, into one main outlet; the friction of such collecting conduits, and the resistances of bends and changes of direction in them becoming principal factors in the power consumed.

In such cases a comparatively high velocity at the outlet is indispensable. A system of ventilation by means of heated chimneys in such cases involving no greater cost would require numerous and ample vertical heated flues so arranged in the construction of the building that the velocity in each flue should be the smallest possible, and the frictional resistances avoided by the most direct passages of the vitiated air to the heated chimneys. A thorough and proper distribution of the incoming fresh air would demand such a distribution also that collecting ducts could be largely dispensed with; or if they were necessary, that they should be as short and as large in size as the conditions of least resistance might demand.

Such a system might, in many cases, be preferable to one involving the use of a fan even in large buildings; but unless such buildings have been designed with this plan in view, proper inlets for fresh air forming a part of the plan, it is difficult to apply it with success.

In nearly all public buildings of large size, which come under the head of old buildings in which the necessities of proper ventilation were originally neglected, the fan will probably be found to be the most efficient remedy for deficient ventilation.

ROOFING-SLATE IN INDIA.

United States Consulate, Singapore, March 8, 1886.

I AM informed that the manufacturers of black roofing slate in the United States are desirous to obtain information respecting the uses of that article in India; that the slate area in the State of Pennsylvania was almost inexhaustible and as rapidly developed as the demand increased; that the manufacturers were desirous of extending their exportations to India; that large quantities had been shipped to Australia and other distant countries.

Last year I answered Messrs. Boyle & Co., slate-exporting financiers, of Philadelphia, anxious to extend their trade hereabouts, after recommending to them the appointment of an agency, to send to the same a trial consignment (which holds good to-day), as follows:

Thus far little slate for roofing has been used, tiles being generally used throughout India; and for cheap, light buildings (bungalows) the leaf of the attap palm (thatch). It would be best to forward and consign a sufficient quantity for trial and introduction. I feel morally certain that without doing this you will not get orders. What slate has been used here for roofing (on Government buildings chiefly), was imported from England, and you are better able to judge as to whether you can compete with that country. The cost of freight on a sailing vessel would be about the same from Philadelphia as from an English port, I think.

Being directed to report upon all India, I must confess that, while I am pretty well informed about that vast country and islands belonging thereto (British and Dutch), I have never yet been in Upper India; but there are many here who have been there, and they tell me that for roofing houses about the same materials are used as in this colony, as follows:

MANNER OF ROOFING.

1. For all substantial buildings (governmental, mercantile, and residential), the *half-round tile* (made of brick clay and baked) is used. These are easily laid (joining in and out, under and over, and overlapping each other), and makes an excellent, durable, as well as cool roof in a tropical country, as they furnish air currents throughout (in a cold climate, unless covered with water or cement where they lap and join, they would not answer). A tile roof is, of course, very heavy, but as there is an abundance of very hard wood out of which to make timbers and frames able to bear it, it does not matter. Cooly labor is very cheap (ranging for all India from eight to twenty cents per day), clay and fuel abundant, and as a rule very near each other, and therefore tiles can be had cheap.

2. For plantation and cheap European residences, bungalows, and the dwellings of the native population in suburban and country districts and on farms, all having, as a rule, far-projecting roofs, the leaves of the attap-palm, the kadjang (a species of huge grass growing on low, marshy river-bottoms, shallow lakes, and lagoons in vast fields, as I have seen in the swamps of Kassang River, near Malacca),[1] and sundry other tough broad grasses and fibres suitable for thatching, are used and give general satisfaction, being very abundant, cheap, and answering their purpose well. A well-made attap or kadjang roof will last from three to four years, when it becomes brittle and as a consequence leaky, and must be removed.

3. For the roofs of coal sheds, wharves, warehouses, landings, bazaars and markets, verandas, and other airy, light shed-like structures, having no walls and only posts or brick pillars for support, corrugated sheet-iron or fluted zinc sheets, this, with steadily increasing tendency is used. This kind of roofing was first introduced here about twelve years ago.

NO PRESENT MARKET FOR SLATE.

As to *black slate* for roofing, it has been used, to my knowledge, on two new Government buildings having mansard roofs within the last two years, *i. e.*, police headquarters and post-office, one mercantile building, and two churches. This slate, as none has ever been kept for sale here, was imported from Wales, where, there being large quarries of it, I am told it is very cheap.

Firms in the United States engaged in the manufacture and export of slate can easily find out whether they can successfully compete with English quarries in Eastern markets, the cost of freight being about the same from our Atlantic as from ports in England (on sailing vessels, I mean).

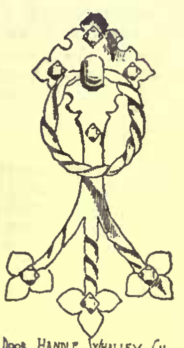
Summed up, upon careful consideration and reflection (referring more to my consular district than all India), I hardly think that the sale of slate for roofing, from *any* country, will ever amount to much in the tropical part of Asia. But as some will be used, perhaps more and more as civilization, with a higher taste for architecture advances, it would, I think, be well for our American slate exporters to create agencies in the principal ports of India, and to forward to them trial consignments (not too small) of their productions. I know of no better way, if they can only compete with English or European exporters. It must be borne in mind at the same time that Calcutta, and perhaps Bombay excepted, we have no American firms in British or Netherlands India, and *must* rely on foreign merchants for the sale of any kind of American merchandise.

[1] I have read in some naturalist's books that the kadjang is a palm-leaf, which is *absolutely* not the case. It grows about as tall as an average corn-stalk out of water; its leaves resemble, in shape and length and breadth, a corn-leaf, but have a saw-like jagged edge. The stem of the kadjang is about as thick as a corn-stalk, and as *readily cut*.

I would recommend the creation of agencies at the following ports: Calcutta, Rangoon, Madras, Bombay, Colombo (Ceylon), Singapore, and Penang, Bangkok (Siam); Batavia, Sourabaya, and Samarang, in Java, and Manilla (Philippine Islands).

A. G. STUDER, *Consul.*

THE FREEZING PROCESS AS APPLIED TO QUICK-SAND FOUNDATIONS.[1]



Door Handle. Whalley Ch. Lancashire. Eng. After sketch by W. Baly. AA Sketch Book. London.

A RATHER remarkable application of refrigeration was made towards the close of last year by Captain Lindmark, of the Swedish Royal Engineers, who was engaged in the construction of a tunnel for foot-passengers through a hill in Stockholm, on the top of which were built residential houses. The workmen came upon some ground, consisting of gravel mixed with clay and water, which had so little cohesion that the ordinary method of excavation had to be abandoned and the works stopped, owing to a subsidence in the earth above, which endangered the safety of the houses. Underpinning was out of the question, on account of the great expense. Under these circumstances it was decided to freeze the running ground, and to use cold air for the purpose as being most readily applied. One of the author's horizontal machines, capable of delivering 25,000 cubic feet of air per hour was accordingly supplied by Messrs. Siebe, Gorman & Co., and was erected in the tunnel as close as possible to the required spot. The innermost end of the tunnel next the face was formed into a freezing-chamber by means of partition walls, which were made of a double layer of wood filled-in between with charcoal. In the middle of last September the works were resumed. After the refrigerator had run for 60 hours continuously, the gravel was frozen into a hard mass to a depth varying from five feet near the bottom of the tunnel to one foot near the top. At the crown no freezing took place; and though the temperature at the bottom of the chamber was as low as 40° Fahrenheit below zero, a thermometer placed at the top, 16 feet above the floor, indicated 32° above zero. This circumstance however was an advantage rather than otherwise, because in any case the roof would have had to be supported by planking, which would have been difficult to drive into the gravel had it been actually frozen at that part. The work was proceeded with in lengths of five feet, the excavation commencing at the top; and a temporary iron wall, made up of plates 12 inches square, was built in against the face from the top downwards as the cutting away of the gravel proceeded. For 8 feet to 10 feet up from the bottom no protection was needed, as the frozen gravel formed such a hard solid mass that it had to be removed with special tools. After once fairly starting, it was sufficient to run the cold-air machine on the average from 10 to 12 hours every night, excepting after heavy rains, when much water percolated through the gravel. The machine worked all the time without a single hitch, and delivered the air at a temperature of 67° Fahrenheit below zero. The temperature of the freezing chamber was generally from 6° to 15° Fahrenheit below zero after 12 hours' running; but it soon rose to freezing point when the men began to work. After two five-foot lengths had been excavated, the partition-wall was moved forward; the capacity of the freezing-chamber varied thus from 3,000 to 6,000 cubic feet. The arching of the tunnel was completed as rapidly as possible close up to the temporary iron wall, while the ground was still frozen. This method of driving the tunnel was employed through a distance of about 80 feet, with entire success. In the residential house to the north, neither subsidence nor cracks were perceptible three months after the tunnel was completed at this point. In the house to the south, the front has subsided about an inch, causing some small cracks in the walls; but this house was not so well built as the other, subsidences having taken place in it before the tunnel was commenced. The daily progress while using the freezing process averaged about one foot.[2]

Although this is the first instance in which a dry-air refrigerator has been applied for the freezing of running ground, it is not the first in which refrigeration has been used for that purpose. As early as 1862 an ether machine was constructed by Messrs. Siebe, Gorman & Co., for freezing a quicksand met with in sinking a well. In that case pipes formed into a coil of larger diameter than the lining of the well were sunk into the quicksand, which was then frozen solid by circulating cold brine through the pipes. The excavation was then proceeded with, the lining put in, the circulation of brine stopped, and the coil removed. The same plan has recently been adopted by Mr. Poetsch, in Germany, in connection with the sinking of colliery shafts; but instead of a coil a series of vertical iron-pipes are used, arranged in a circle, the effect of course being precisely the same.[3] For driving the Stockholm tunnel, however, it is difficult to see how freezing by means of brine could have been applied, the excavation being horizontal instead of vertical.

TABLE I.

FREEZING MIXTURES.

Composition by Weight.		Reduction of Temperature in Degrees Fahr. deg. deg. deg.
Ammonium nitrate	1 part	From + 50 to + 4 = 46
Water	1 "	
Ammonium chloride	5 parts	From + 50 to + 10 = 40
Potassium nitrate	5 "	
Water	16 "	
Ammonium chloride	5 "	From + 50 to + 4 = 46
Potassium nitrate	5 "	
Sodium sulphate	8 "	
Water	16 "	
Sodium nitrate	3 "	From + 50 to − 3 = 53
Nitric acid diluted	2 "	
Ammonium nitrate	1 "	From + 50 to − 7 = 57
Sodium carbonate	1 "	
Water	1 "	
Sodium phosphate	9 "	From + 50 to − 12 = 62
Nitric acid diluted	4 "	
Sodium sulphate	8 "	From + 50 to − 0 = 50
Hydrochloric acid	9 "	
Sodium sulphate	5 "	From + 50 to + 3 = 47
Sulphuric acid diluted	4 "	
Sodium sulphate	6 "	From + 50 to − 10 = 60
Ammonium chloride	4 "	
Potassium nitrate	2 "	
Nitric acid diluted	4 "	
Sodium sulphate	6 "	From + 50 to − 40 = 90
Ammonium nitrate	5 "	
Nitric acid diluted	4 "	
Snow or pounded ice	2 "	To − 5
Sodium chloride	1 "	
Snow or pounded ice	5 "	To − 12
Sodium chloride	2 "	
Ammonium chloride	1 "	
Snow or pounded ice	24 "	To − 18
Sodium chloride	10 "	
Ammonium chloride	5 "	
Potassium nitrate	5 "	
Snow or pounded ice	12 "	To − 25
Sodium chloride	5 "	
Ammonium nitrate	5 "	
Snow	3 "	From + 32 to − 23 = 55
Sulphuric acid diluted	2 "	
Snow	8 "	From + 32 to − 27 = 59
Hydrochloric acid	5 "	
Snow	7 "	From + 32 to − 30 = 62
Nitric acid diluted	4 "	
Snow	4 "	From + 32 to − 40 = 72
Calcium chloride	5 "	
Snow	2 "	From + 32 to − 50 = 82
Calcium chloride crystallized	3 "	
Snow	3 "	From + 32 to − 51 = 83
Potash	4 "	

TABLE II.

EVAPORATION OF LIQUIDS.

Liquid or Gas.		Water.	Anhydrous ammonia.	Sulphuric ether.	Methylic ether.	Sulphur dioxide.	Pictet's liquid.
Specific gravity of vapor, compared with air = 1.000		0.622	0.59	2.24	1.61	2.24	
Boiling point at atmospheric pressure, deg. Fahr.		212	—37.3	96	—10.5	14	—2.2
Latent heat of vaporization at atmospheric pressure, units.		966	900	165	..	182	
Absolute vapor tensions in pounds per square inch at different temperatures.	deg. Fahr.	lb.	lb.	lb.	lb.	lb	lb.
	—40						
	—20	..	19.4	..	12.0	5.7	11.6
	0	..	30.0	1.5	18.7	9.8	15.4
	+20	..	47.7	2.6	28.1	16.9	22.0
	+32	0.089	61.5	3.6	36.0	22.7	27.0
	+40	0.122	73.0	4.5	42.5	27.3	31.3
	+60	0.254	108.0	7.2	61.0	41.4	44.0
	+80	0.503	152.4	10.9	86.1	60.2	60.0
	100	0.942	210.6	16.2	118.0	84.5	79.1
	120	1.685	283,7	23.5	..	117.5	99.7
	140	2.879	..	33.5			
	160	4.731	..	45.6			
	180	7.511	..	62.0			
	200	11.526	..	81.8			
	212	14.7	..	96.0			

[1] From a paper by Mr. T. B. Lightfoot read before the Institution of Mechanical Engineers, and printed in *Engineering*.

[2] A full description of the construction of this tunnel is given in *The Engineer* of April 9, 1886, page 282.

[3] Further particulars of Poetsch's process are given in *The Engineer* of November 30, 1883, page 417.

COMMUNICATIONS

[*We cannot pay attention to the demands of correspondents who forget to give their names and addresses as guaranty of good faith.*]

A QUESTION OF COMMISSION.

MILFORD, MASS., Aug. 14, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,— What would be a proper charge to make for services on drawings under the following circumstances: A corporation appoint a committee to build a building. The committee go to the office of an architect of good reputation and employ him to make

sketches and estimates — first, an approximate estimate, second, a definite estimate as to the entire cost of building, together with further sketches introducing changes which they desire. They then decide to build, and go to the architect and make a verbal agreement for plans and specifications at two and one-half per cent. The architect commences work, and has the working-drawings partially laid out, when he is notified to stop until said committee can decide on a change they wish to make, which they say will be completed in a few days. They fully understand that the architect has taken this work with the understanding that it must be completed within three weeks, ready for estimates. Two weeks pass; no instructions received, the architect writes to committee, but receives no answer. Finally, four weeks after, they send him a letter and say they have decided to use another architect's plans. All this time the architect has held himself in readiness to complete this work, and has suffered by delay of committee, who knew they were to employ another architect, simply to please one man of said committee, and had decided to do so three weeks before they notified the architect of the fact. The cost of building was estimated at $11,000. Now, what would be the charges under these conditions? Please answer in your next issue, and oblige Respectfully yours, FRED SWASEY.

[WE trust our correspondent will be able to give this building-committee a lesson — in economy, at least, for we suppose that they do not imagine that in addition to the payment they must make to the architect they are now employing, they must pay our correspondent for the services he has rendered before his summary supersession as follows: One per cent for his preliminary sketches; one-half of one per cent for his "definite estimate," and the alterations in his original sketches which were made at the request of the committee, and a fair *per diem* for the time spent on the working-drawings. If the specifications were written, which does not appear, we should say our correspondent was entitled to nearly two per cent on the estimated cost.— EDS. AMERICAN ARCHITECT.]

THE CAPITOL TERRACE.

BROOKLINE, MASS., August 17, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs,—You express regret that in my note to you of last week nothing was said of the feasibility of lighting some of the rooms from the outside, and observe that "if the real economical and practical value of the new [outer] rooms is their capacity as storage-rooms for rarely-visited archives, the matter of external light is of no consequence, and the designing of the terrace is architecturally correct."

In the observations that led to my note, a doubting view had appeared as to certain points of fact, and my purpose in writing was simply to state reassuring circumstances. As to the purposes for which the rooms in question are needed, it is a matter of opinion. The weight of opinion is strongly in the direction that you suggest. The plan has been under discussion twelve years, and until this year it has not, to my knowledge, been thought desirable by any member of Congress, or any one interested, that the rooms should be prepared with reference to any other use than storage. The first suggestion of windows in the outer wall was made by a member of the House, who gave no reason for thinking them desirable except that the terrace would be more ornamental if round openings, with suitable decorative borders, were introduced in the blank spaces between the piers. Afterwards the proposition was urged by others on grounds of utility. The question thus coming up, the proper committees of the House and the Senate were both of the opinion that the rooms would be required only for storage, and both Houses afterwards acted on this view, voting that the work should go on without change of plan in that respect. Yours respectfully,

F. L. O.

THE ALLEGHENY CEMETERY COMPETITION.

GALVESTON, TEXAS, Aug. 12, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs,— Would you be kind enough to let me know what set of plans were adopted by the Allegheny Cemetery Managers, and, if possible, would like to see them published in your paper. The plans referred to were advertised for up to the 1st of July.

Respectfully, B. G. CHISHOLM.

[PERHAPS the successful competitor will himself reveal his name.— EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

A NEW USE FOR ITALIAN MOSAICS.— The curious suggestion has been made by Mr. Francis Galton, of the London Anthropological Institute, that some of the colors of the Italian Mosaic-workers be employed as standards for describing the tints of the skin of the various races and tribes of mankind. These colors have great durability, mosaics in St. Peter's at Rome having shown no signs of change after more than a century. A great variety of tints is available, there being about five hundred appropriate to the flesh of European nations alone.— *Exchange.*

CARTHAGINIAN MOSAICS. — Not long ago some highly artistic relics of ancient Carthage were disposed of at an auction in London. Two of the finest of these are mosaics, in splendid preservation, each about three feet square. The one represents a woman robed and wearing a crown of flowers, with a naked youth sitting beside her; and the other, a youth carrying on his shoulders an eagle. These have been called "Peace" and "War," but there seems to be no authority for this. Both works are evidently early Carthaginian, and must have belonged to a period when Carthage held a high position as a nursery of art, especially in the beautiful art of mosaic work, of which ancient Greece has left no trace, while the mosaics of Rome are of a much later date. It will be remembered that Carthage was celebrated for her beautiful colored marbles, and for the wonderful skill of her artists and workmen, which were known throughout the civilized world, for Carthage was a large city 140 years before the foundations of Rome were laid. It is possible, therefore, that the peculiar art of working in mosaic may have been originated in Carthage, and may have found its way to Rome, where it might have been practised by Roman, or even Carthaginian artists. But, as a rule, the Roman work is very inferior to the Carthaginian.— *Chambers' Journal.*

TRADE SURVEYS

THE widely published railway statistics, iron-trade statistics, and building statistics all point in the direction of improving industrial and commercial activity. That which most interests the thoughtful business man is, when will the present impulse stop?— for a stop is generally anticipated. A reaction, something like that of 1873 to 1878, is expected by the shallow observer of trade tendencies. Bankers, railroad-managers, and the controllers of immense industrial undertakings, are not acting as though they anticipated any early reaction. Railway statistics are of a favorable character. Share capital has increased only slightly, and the funded debt is but little greater. Earnings are practically the same for two years. Net earnings three and one-half per cent. Earnings per mile decreased from $6,663 in 1884 to $6,265 in 1885. Tonnage was ten per cent greater. The current year is more favorable to traffic and earnings and railroad companies are making more purchases than last year. The iron and steel statistics are equally encouraging. Weekly pig-iron production has increased over twenty-five per cent in six months, viz., from 97,000 tons per week to 122,000 tons per week, with production expanding and prices firm. The rail-makers at Long Branch said they could meet all demands this year, and would turn out 14,500,000 tons, rails enough to lay over 15,000 miles of road. Building interests are also prosperous. Within two weeks large contracts have been placed, especially in the States west of Pennsylvania, for architectural iron, lumber, stone, brick, and general building material. Bricks and lumber have been especially active. For the former, prices declined just enough to draw out a large waiting demand. Heavy contracts have just been placed for delivery of lumber in the West and Northwest. Contracts have also been recently placed for 2,000 freight-cars, and the builders of passenger and palace cars are oversold for three months. While these evidences are encouraging it is well to note a few possibilities on the other side. Investors of capital have been complaining more and more of the uncertainties surrounding the earning capacity of money. Production is making headway against capital, and is gradually becoming more and more independent of it. Last year $267,000,000, in round numbers, was paid as interest and dividends on nearly $8,000,000,000. This ratio of taxation must decrease in the nature of things. The preparatory steps are being taken in a better industrial and manufacturing organization. The same tendency is observable in other directions. In short, profit on invested capital must gradually decrease under the increasing surplus of wealth and the increasing productive capacity. Financiers are beginning to admit what they have long faintly recognized, and are considering how to adjust their interests in the greatest harmony with the new order. The effect of this decrease in cost for money will be as it has been to increase industrial and building activity, and, in short, to work to the interests of the producing millions. It is quite natural to see an anxiety among the industrial interests to promote shipping activity. Another movement has been made by a body calling itself the American Shipping and Industrial League, and which has issued an address to the United Industries of America. This may, and probably does, emanate from an irresponsible body, but it indicates that there is need of just such action. The industrial interests have long recognized that a healthful shipping was necessary. The proposed action of the government in expending several million dollars in the construction of war ships will open the way. The urgency for special machinery continues. Cast and wrought pipe orders are in excess of mill capacity. The money-markets are not so easy as a month ago. Rates are growing stronger in nearly all cities west of the Mississippi. Surplus reserves are decreasing, and government accumulations are increasing. There is an abundant supply of currency, and no fears should exist as to scarcity suddenly causing disaster. Building notes to hand show a falling-off in real estate transactions in New York, Philadelphia, Chicago, and St. Louis. Permits show an increase, especially for small houses. Within thirty days all projected work, or nearly all, will be under way. The architects in these cities are enjoying a vacation well earned. They anticipate but little new work for this season's construction. The building season in Chicago and in several interior towns of Illinois will continue as late as the weather will permit. The heavy shipments of lumber to the West and Northwest betokens sharp activity during the next three months. It is possible that the great activity in railway construction in this region may be overdone. The turmoils of railway managers over rates and percentages are not reassuring. Builder's interests are, however, not jeopardised in the least, though investors in railway bonds may have to wait years for profits. There are tens of thousands of families able to live in better homes, and this unsatisfied demand courts building capital and enterprise. The masses are well employed. Labor is rising equal to the occasion. Discontent will be held in check, and fanatical zeal will be stamped out. The great body of producers are close observers of passing events and can be relied upon to do nothing to upset the general tranquility. The greatest difficulties that beset us are, what to do with our abundance and how to maintain that regular and just distribution which underlies permanent industrial prosperity. Railroad properties may not pay high divinends, but we have them to use. Banking investments may not return immense profits to the possessors, but the capital is there and must accept the most profitable employment offered. In short, if there are any troubles to be feared the producing interests do not share in them, but may safely expect to profit by the better competition and strife developing in all channels of exchange.

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CONTENTS

We were brought to a realizing sense of the change which the due process of development has effected in the *American Architect* when, in having the copies for the half year just passed bound up for our own use, we discovered that the Imperial edition, at least, had become so bulky that it would be very undesirable that the issues for a full year should be bound in one pair of covers. We have, therefore, made preparations for binding this edition in semi-annual volumes, and though this step may entail some extra expense on those who follow our example, we believe that they will find, as we do, that the convenience of having another bound volume ready for use at the end of each six months is well worth what it costs. We regret that we cannot make the price of binding any less for the half-yearly volume than it has been for the yearly volume, but the fact is that the number of double-page plates which require mounting on guards is so great that to do the work properly requires careful handling and much time, so that there is little margin for profit to any one. Moreover, the semi-annual volume of the Imperial edition contains about as much matter as the first yearly volume published, for which our binding prices, since unchanged, were established.

Anarchy received a warning last week at Chicago, which must have shown the least thoughtful amongst the brutal enthusiasts that in this country the times are not ripe for the success of their idea, and that there are as yet not sufficient causes to induce the great laboring classes to join hands with the professional agitators. The fire is smothered but not quenched, and it will depend somewhat on the self-control of the monied classes how soon their poorer fellows shall find themselves unable to longer contemplate unmoved the unequal distribution of the good things of this life. It is possible that the spread of education and the opportunities of graduating from one class to another which this great free country offers to all, may always keep the good sense of the community above the danger line, above the fire-damp of social revolution which, nevertheless, will from time to time doubtless catch fire in one section or another, owing to strictly local causes. It is not, however, possible to conceive that anarchy can ever receive here the glorification which posterity accords to the most famous anarchical movement of all passed time — the French Revolution. There was cause, reason, purpose for such a movement in a country and time when all who were not of the aristocracy were the mere scum of the earth. But in a country of which the chief magistrate may rise by peaceful and lawful steps from the tow-path, the tannery or the lumber camp to the most honored office in the gift of the people, it seems probable that the members of the laboring classes will see that their chances of success depend on their own force of character, more than on extraneous circumstances, and that they will hence always join hands with the middle and wealthy classes in suppressing anarchy whenever it shows its head.

In France, however, though the Communist of to-day is deserving only of the bullet or transportation, the Revolutionist of a century ago is worthy of all honor, and a movement is now making at Paris to celebrate the outbreak of 1789 by the erection of a fitting monument. The historical association of ideas, the sentiment of special appropriateness and the opportunity all unite in pointing to the site of the palace of the Tuileries as the one most suitable for the proposed monument. After remaining for some half-a-dozen years the blasted relic of the madness of the Commune, the palace of Philibert Delorme was at length torn down and its material sold at auction to relic-hunters from all parts of the world, some fragments even finding their way to this country. What should be done with the site has been frequently discussed, particularly since the new street has been cut between the Rue de Rivoli and the Quai des Tuileries, which makes the vacancy even more apparent, and the desirability of the site more evident. The space between the Pavillon de Flore and de Marsan has been utilized by erecting temporary buildings for the use of the municipality, and for the post and telegraph office, until it shall be finally determined how the site can be turned to the best use. Recently M. Chassin, a publicist, suggested that in view of the approaching centenary of the Revolution it would be well to erect a monument in commemoration of the event, and that the best form to give the monument would be that of a museum where could be gathered together all the souvenirs of that epoch that could be collected, the portraits, medals, paintings, archives, memoirs, biographies and all the thousand and one miscellaneous articles that have been treasured in private families or scattered through public institutions. As for the site for the proposed museum, M. Chassin asserted that none could be so suitable as that where the Tuileries formerly stood. The suggestion pleased both the public mind and the official inclination, and it seemed as if the scheme would be carried out without delay. But the Minister of Public Instruction, M. Goblet, who at first was entirely in favor of the project, declared, when it came to the point of expressing himself officially, that the assistance of the Government could not be assured until the plan had been more thoroughly studied both as to cost, and as to the architectural character which was to be given to the building, and next that so far as the site was concerned, it seemed to him to be much larger than was needed for a building whose contents could neither be very numerous nor bulky. This announcement, which seems to us to be very sensible, appears to have thrown the promoters of the scheme into unnecessary consternation.

A short time ago a number of owners of much valuable real estate and the representatives of some of the fire-insurance companies petitioned the Boston Water-Board to extend the high-service system so as to afford a better protection to the valuable buildings in the neighborhood of State Street and Post-office Square, and we have no doubt that the appeal thus made will be ultimately successful. Of immediate result we suppose there is small hope, as we suppose funds for the execution of the work would have to be provided by the city government, which is understood to give its attention mainly to the making of a reputation for economical administration, with a view to its own reëlection, rather than to a judicious consideration of the best interests of the city, which are temporarily entrusted to their care. This petitioning by men of weight in the Boston community is an amusing instance of the different ways in which things are done in that city and in New York. In New York the cart is put frankly before the horse, the job is everything, the needs are often factitious. When, in New York a year or two ago, the bosses found themselves obliged to find work for their adherents and a means of lining their own pockets, they devised the necessity of supplying the city with more water, so that their followers might find employment in the great aqueduct now building, and they might make a profit through handling the contracts. A water-famine was skilfully talked up, and the danger to health and property was portrayed with all necessary vividness; but as material evidence was needed, they procured it in such a form that the supply did seem inadequate and failing, the pressure on the main being sufficient only to carry water to the first floor of buildings, to the upper stories of which it had formerly found its way. The evidence was irrefutable, the need self-evident, and the aqueduct work put in hand. This safely effected, the manipulators

saw no further need of keeping the city on short commons, and the normal pressure was once more allowed to have its effect, and water once more flowed from arid taps and faucets. The new aqueduct is, of course, a very far from useless municipal enterprise, although it is doubtful whether it is yet actually needed, but the means employed to bring it into being are none the less amusing. Boston only seeks to have the present high-service extended so as to serve portions of the city which have always lacked the convenience and protection that other parts of the city have enjoyed for years.

BECAUSE of what we said last week about the Bennington Battle-Monument, Mr. Rinn, the author of the accepted design, found it worth while to bring us a large scale-drawing of the monument as it is now proposed to execute it, for the purpose of showing us that our comments of a year ago were not inappropriate or misapplied, and that our remarks last week, while depicting fairly the original design, which, it seems, is the one of which we saw a photograph, did not describe the latest phase of the design. How far the refinement of line, which is of so much value on paper, will be effective in execution in walls of split-face work, we hope some time to have a chance of observing; but we fear that even if in itself it is successful, it would be more so on a site where its qualities would tell for all they are worth; that is, we have a feeling that the obelisk is not the best form to adopt for a site such as we understand the one at Bennington to be. It seems to us that a three-hundred-foot shaft of the proportions chosen will look too thin and needle-like, and that in the absence of anything to give it scale it will lack that which gives to the Bunker Hill shaft whatever it possesses of interest as a structure, if not as a design.

THE English engineers are considerably exercised over the fact that the contract for a large iron bridge in Australia, to cost two million dollars, has been awarded to an American bridge-building company, but, with their usual fairness, instead of trying to depreciate their rivals, they seem to be endeavoring to learn for their own improvement the reasons for the superior economy of the American methods of bridge-building. The principal reason, which includes, perhaps, all the rest, is certainly to be found in the great experience which American specialists have had for the past twenty years in bridge construction. With us the work of designing iron railroad or highway bridges rarely falls, as in Europe, upon engineers in general practice. The volume of the bridge-building business in a country which builds three or four thousand miles of railway a year, and reconstructs nearly as much more by the substitution of iron for wood in the smaller bridges on the line is so enormous that it has become a specialty in the hands of five or six great corporations which employ at high salaries the best engineers to be had and maintain immense foundries and rolling-mills where nothing is done except to manufacture eye-bars, lattices and the other members of bridge construction. The competition between these corporations is so great that the ingenuity of their engineers is taxed to the utmost to reduce the weight and cost of the bridges which they design to the lowest point consistent with safety, while the correctness of their construction is practically guaranteed by the same rivalry between the managers of each corporation, always on the alert to discover defects in the work of the others, and the natural consequence is that the skill of men of ability concentrated for years in sharp competition with others of equal ability upon a single subject, has produced its natural result in bringing to great perfection the details of all the processes relating to that subject.

THE most obvious difference that the English engineers find between their own systems of bridge construction and that of the American engineers consists in the extensive use of eye-bars by the latter for all members which have to endure a tensile strain. It is usual in American bridge-building shops to lay out the lengths of the different members with great accuracy, one sixty-fourth of an inch being, we believe, the maximum variation allowed, and eye-bars which are gauged and drilled at the shop and put together with turned steel pins can be fitted with far greater accuracy and are therefore put together on the ground much more quickly and securely than the old-fashioned riveted members which are still used abroad for resisting tensile strains. Although the Americans have sometimes been reproached for allowing the safety of their bridges to depend upon the strength of a single pin or bolt instead of securing them by a multitude of rivets, the failure of one of which would not involve the ruin of the structure, the construction with pin-joints allows, or rather invites a care and accuracy in the inspection of every part which, perhaps, do more to promote real security than the habit of depending upon the indefinite and uncalculable resistance of riveted joints. A correspondent of *Engineering* suggests further that the practice which American bridge-builders have had in designing bridges for single-track railroads has been of value to them by obliging them to take careful note of the wind-pressure upon these narrow structures, and to provide against it by a particularly well-considered system of bracing and strengthening.

WE understand that M. de Lesseps has succeeded in having a large part of his new loan of one hundred and twenty million francs taken up, mainly it is said by females of the peasant class. If half that is said about the real condition of affairs at the Isthmus is true, this enterprising enthusiast is likely to prove one of the greatest moral scoundrels of the age, and we do not envy him the objurgations which, when failure is at length acknowledged, will shower upon him. But there are some things which even the magnetic de Lesseps cannot accomplish, and we are not surprised that in face of the doubtful condition of his undertaking at the Isthmus of Panama the Tunisian Government has refused to allow him to undertake the flooding of the chotts that lie between the coast of the Mediterranean and the great desert to the south of them. M. de Lesseps estimated that the cost of digging the canal that would be necessary for this immense irrigation scheme would be forty million dollars, which he probably looks on as a mere bagatelle, but which the canny Africans seem to believe could hardly be raised by a man who already finds it hard to raise money for the prosecution of an enterprise in which the whole world is interested, and of which the bonds and securities can be bought in any market, if any one thinks them worth the purchase.

IT is reported from Steubenville, Ohio, a town of some twelve or thirteen thousand inhabitants, that for two years one of its main streets has been paved with fire-brick, and, under such traffic as a town of the size affords, has given better satisfaction than any material yet tried, wearing well, being comparatively noiseless, and giving a good foothold for horses. Its chief recommendation, however, seems to be its cheapness, as it costs only eighty-three cents per yard to lay it, as against the two dollars and a half or three dollars which Belgian blocks cost. The bricks are laid on edge, on a four-inch bed of sand, which in turn is spread over a bed of gravel of the same thickness. Paving bricks have been used for street pavement before, but never with very great success, as it did not seem possible to get bricks of even hardness, and just as soon as the softer of the bricks began to give way, the wear at that point increased very rapidly. With fire-bricks it may be possible to secure a more even burning, and perhaps the color of the brick makes it easier to cull out the soft ones. The Steubenville clay may contain an unusual amount of iron, and so makes a more compact and more resisting brick than is to be found in other places, for there are many ordinary bricks that will withstand as high a crushing strain as the common fire-brick.

A LITTLE paragraph has been going the rounds of the technical journals about the painting of tin roofs, which seems to contain a valuable suggestion. Most persons suppose that a tin roof ought to be left exposed to the weather for a month or so, until the iron of the plates has corroded enough to cover the tinned surface with a tinge of rust, probably forced through the pores of the coating. The theory of this notion seems to be that paint will not stick to a fresh surface of tin, which is apt to be greasy as well as smooth, and that the slight roughness given by the rust is of value for holding the paint; but the writer of the paragraph in question believes that if painting is delayed until oxidation has begun, the action continues beneath the coating, until the plates are destroyed, while a layer of paint put on over fresh plates would defend them for an indefinite period from the commencement of oxidation. There is certainly a possibility that this view of the matter is the correct one, and architects, who have many opportunities for observing the weathering of roofs, might do their fellow-citizens a service by investigating the facts with care.

NOTES OF TRAVEL.

SALAMANCA.



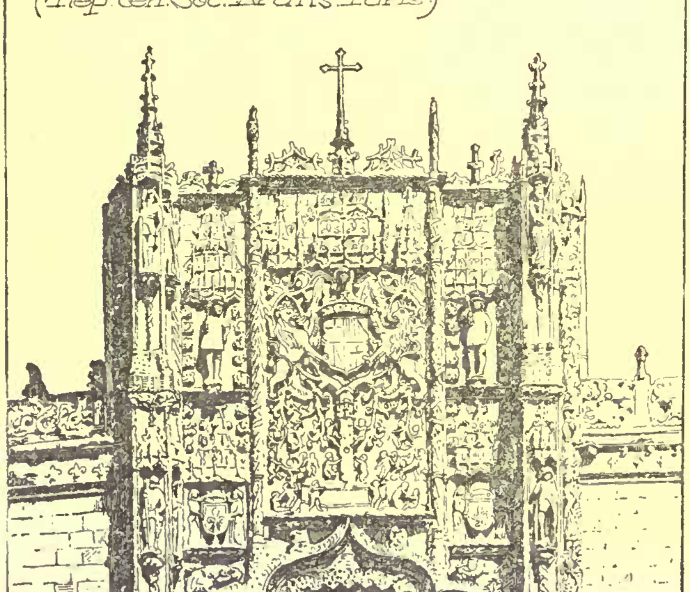
MEMORIAL TABLET. ALLHALLOWS BARKING ·CH LONDON.
AFTER SKETCH BY ROBERT W. GIBSON
AA·SKETCH BOOK LONDON

It is difficult to write or speak dispassionately of Spain, or to measure calmly and fairly the architecture of that wonderful country. Considered from Italian or French standards of taste, a major portion of the work would be pronounced doubtful if not decidedly bad; and yet one never feels like establishing architectural comparisons between Spain and any other country in the world, and the critic must be cold-blooded indeed who would undertake to judge and analyze such examples as the Court of the Lions at Grenada, or the thousand-columned mosque at Cordova. Somehow, even the humbler things become glorified by Spanish associations and surroundings, so that a very little attempt at architectural adornment will seem to count for much more than would be expected anywhere else. And thence it comes that not an artist or architect can visit the country without, to a greater or less extent, losing his head over the delightful surprises that await him in nearly every city of the peninsular. Spain is the paradise of the impressionists, the country of bright, dazzling glimpses, and unexpected, bewildering beauties; sharp contrasts and warm floods of color; a land whose remembrance after a rapid visit could be fairly epitomized by some of the fans one sees in the Madrid shop-windows, decorated with a few shapely figures clad in vivid colors, a mantilla thrown over glossy, black hair, a background of rich, old, sunlit architecture, and, perhaps, at one side the dark shadow of the nation's curse — the bull-fight.

But to most people the name of Spain calls up no other thought than of the fairy-like idyls of Andalusia, the wonderful Moorish architecture. They forget that Spain was ruled by the Goths before Mohamet was born, and that this style, beautiful as it is, was never more than an exotic, whose growth ceased the moment the Moors repassed the Strait of Gibraltar: and even of the many architects who yearly visit Spain — for it is no longer the *terra incognita* it was to the profession a generation ago — few ever go farther north than Madrid; and yet the old kingdom of Leon, up among the northern mountains, is full of interesting and valuable old work, there being hardly a village but has at least one good bit of architecture. Avila, Zamora and Toro are especially well endowed, while chief of all is the ancient city of Salamanca, "*muy noble y muy leal*," as its device reads, a city so full of good architecture and so little disturbed in its quaint old habits and customs by the march of what in Spain is called modern civilization, that for the architect as well as for the simple tourist it can fairly be termed the most interesting city in the whole realm. If there is one other equal to it, it can only be Toledo. The southern cities have one or two buildings to study from, while Salamanca has twenty. In Andalusia, stucco and whitewash take the place of honest masonry, while in Salamanca everything is built with a beautiful, smooth-grained sandstone, of a warm burnt-sienna color, capable of being carved with the fineness of ivory, and resisting the weather so well that even after six centuries of wear the work is as fresh as though cut yesterday; hence, there is none of the dilapidation which meets one at Toledo and elsewhere. The best efforts of Spanish architects have been put forth at Salamanca. The city has not a great deal of work of the periods ante-dating the Renaissance, as the city was in great part destroyed by the Moors about the thirteenth century; but Alfonso VI, and especially their Catholic Majesties, Ferdinand and Isabella, made it so great and rich that wars have passed very lightly over it ever since. It has always been a wealthy city, and the old Spanish traditions have been better preserved here than perhaps anywhere else. The railroad came in only a few years ago, and seems thus far to have made little change in the old ways.

To attempt a detailed description of the city whose architectural riches gained for it at one time the name of the Spanish Rome, would be a task quite outside the limits of this paper. Only a few of the more notable edifices can be considered, and first of these is naturally the cathedral, a great pile erected on the highest ground of the city, rising with considerable grandeur above the house-tops and crowned by its lofty dome. The view shown by the sketch is from a road some distance to the rear of the choir, and is, perhaps, the best that can be had, as the streets are too crooked and narrow to permit of a general survey from any other direction. The cathedral was begun in 1513, and the construction continued through more than two centuries, in a style which is Gothic in all its main ideas, though infused with so strong a Renaissance feeling that it becomes almost a style to itself. It is, indeed, a rather curious mixture. The façade is completely covered with work; the arches at the portals are pointed, and the foliage and mouldings are certainly not Renaissance; but the bas-reliefs and sculptures are almost classic in their purity, and the arrangement of the parts of the façade and the schemes of decoration are as thoroughly Renaissance as anything could be. The effect, while confused and tiresome in its entirety, is pleasing and delicate in detail. The dome, over the centre of the church, is of too late construction to be anything but pure Renaissance. The tall tower at the left has a rather curious history. It was built after the design of Churriguera, an architect who was noted more for the extravagant exuberance of his ideas than for his good taste; indeed, the name *churrigueresco* is used to designate any piece of Spanish architecture which is wildly *baroque* in character. Fortunately, the municipality of Salamanca became alarmed by the terrible earthquake at Lisbon in 1755, and fearing that Churriguera's tower might some day come tumbling down about their heads, they took the strange precaution to encase the lower portion in solid masonry, leaving it as it is now, whereby the effect was greatly improved, as the earlier work was doubtless of a character which would gain by obliteration. The low cupola in front of this tower is a portion of the old cathedral, for Salamanca boasts of two cathedrals. The older building is of uncertain age, but probably dates from about the end of the eleventh century, being entirely Romanesque — perhaps the best and purest example of the style in Spain — and quite equal in excellence to French work of the corresponding period, though a Frenchman would hardly be willing to admit it as such. The mouldings are good and well chosen; there is all the simple dignity which is so pleasing in the French work; the little carving employed is judiciously chosen, and the central tower is really a *chef-d'œuvre* of its kind. In general disposition this tower is not unlike that of our own Trinity Church in Boston, though it is on a somewhat smaller scale. It is circular in plan, with turrets at each diagonal, and slightly projected bays, capped by steep gables. The roof is of stone. The tower is so hedged about by the constructions of the new cathedral, which enclose it on three sides, that it is difficult to find a position from which it can be viewed to advantage. The windows are in two tiers, though the lower is so hidden that it can hardly be seen from any point. The details are thoroughly enjoyable, if such an expression may be applied to architectural forms—so simple and yet so effective: not a hammer-stroke wasted, not a moulding which does not count for all it is worth, not a leaf of carving misapplied or lost; no obtrusive terminations, and yet with no lack of vigor. Well proportioned in every respect, the design is a noble exponent of a noble

Gateway – San Gregorio, at Valladolid, Spain
(Rep. Gen. Soc. Archts Paris.)



style, and an example which no American student can afford to neglect. The old cathedral has been very thoroughly published in the huge and exhaustive work issued in folio by the Spanish Government under the title of "*Monumentos Arquitectonicos de España.*"

The interior of the old cathedral consists of a three-aisled nave, with one transept (the other having been absorbed into the more modern church) and a short apsis without aisles. The design is perfectly plain, there being only a few carved capitols in the nave and a little attempt at design in the interior of the cupola; not very successful, however. The new cathedral was built immediately adjoining the old, the north walls of the latter serving for both, though the sharp rise in the ground necessitated a difference of level between the two of eight feet or more. The interior of the new cathedral is more purely Gothic in character than the exterior, but it has not as much interest, being more precise and mechanical in design, and offering little opportunity for the picturesque. The effect of the tall nave, with its high, slender-shafted piers, might not be bad if one could rightly appreciate it; but, as in nearly all Spanish churches, the view is broken by a high, marble screen of elaborate late Renaissance design, which entirely encloses more than three-quarters of the nave. In plan, the cathedral is three-aisled, with lateral chapels all around.

The chapter-house, built in a rambling fashion about a small cloister adjoining the old cathedral, has a number of attractions: some interesting old woodwork; some early Renaissance furniture, excellently designed; and in a side chapel, enclosing the tomb of one of the early bishops, a tall screen of wrought-iron, the most elaborate and the best of the many good examples of ironwork with which Spain abounds, but, unfortunately, in so dark a place that it can be neither seen nor drawn to advantage, and much less photographed with any success; at least, no photographer has yet been enterprising enough to attempt it, though for that matter not one-quarter of Salamanca has been photographed.

Across the street from the cathedral is the university, an instituton which is but the shadow of what it was in its palmy days. It is asserted to be the oldest of its kind in existence. During the fourteenth century it stood second among the four great universities of Europe — Paris, Salamanca, Oxford and Bologna — and claimed more than ten thousand students. The old buildings and the old systems still remain, but the glory is entirely of the past, and the students number scarcely over three hundred. Architecturally, however, the university has changed but little during the past three centuries and a half. The principal or western façade was erected by Ferdinand and Isabella, and of all the overwrought pieces of work which Spain has produced, this is certainly by far the most elaborate. The disposition is simple enough; below, a double doorway; above, a wall, perhaps thirty feet in height, without a window or opening of any kind, but every inch of the space covered with carved ornamentation. Springing from corbels at each side of the doorway are wide pilasters extended the whole height of the façade. The wall is crossed by two lines of string-courses, and the first and second horizontal divisions above the doorway are sub-divided by pilasters into five panels, filled with armorial bearings, medallion-portraits and finely-designed arabesques. The uppermost division is occupied in the centre by a niche enclosing a group which represents the pope giving sanction and privileges to the University, while on each side are other medallions and more elaborate arabesques. The whole façade is crowned by a rich cornice. But a mere description can give very little idea of the character of the design. It can only be compared to one of those ivory caskets which are sometimes found in museums, carved and ornamented to the last degree; as delicate as lace-work, and often quite as meaningless in general design. But fortunately there is something more than mere quantity of work to this façade. The general effect is fussy, overwrought and tiresome, but each detail is a gem by itself. Indeed, it is astonishing how work of such superior excellence in its parts should be so lacking in comprehensive design. It is a real delight to examine closely the individual features, and note how gracefully the arabesques are adapted to the spaces they occupy, how pure and sharply cut are the mouldings and constructional lines of detail, and how naïve and beautifully composed are the medallion-portraits and reliefs. The large double medallion over the centre representing Ferdinand and Isabella is worthy to rank as the finest carving Spanish artists have ever produced. Not a feature of the façade is neglected; and if one cannot wholly approve of the quantity, the quality of the work will suit even the most exacting critic.

There is less to the interior of the university than one might expect from its past magnificent history. The apartments are arranged about a quaint, sunny, old court-yard. Towards the front is the library, closed off by a handsome wrought-iron grille. On the right is the chapel, hung with rich tapestries, and fitted with good wood mosaics and inlays; and on the left are some of the old class-rooms preserved in exactly the condition they were centuries ago, with the same narrow, wooden benches, and much-be-backed and carved desks which served when Fra Luis de Leon was the foremost teacher of the land. To the west of the university is the Instituto, formerly an annex of the larger school, a building with an interesting court-yard and an elaborate entrance-way. The property once occupied by the university is quite extensive, but most of it having been converted into dwellings, there is little of architectural value aside from what has been already noticed.

Of the many interesting churches which Salamanca possesses, San Estaban or Santo Domingo is the most elaborate, after the cathedral. The façade has the same fault as that of the university; an excessive richness of beautiful details badly combined. Some of the statues which adorn the font are really excellent, notably a figure of the Virgin which much resembles the celebrated statue by Veit Stoss, in Nuremberg. The interior of the church has the peculiarity, almost unique in Spain, of presenting an unobstructed nave, the choir being installed in a broad gallery over the entrance. The large cloister adjoining the church is quite interesting in its way, lacking the richness which marks the exterior façade, but composed much better and with a general effect which is quite charming. There are few Renaissance cloisters in Europe, and fewer yet which have anything like the picturesque value Santo Domingo possesses. The conditions here are exactly the reverse of what they are on the exterior. The details are not very good nor well chosen, and the whole charm depends upon the general scheme, perhaps also not a little on the effect of the flowers and shrubs growing in wild profusion in the open centre, and on the vivifying influence of the warm Spanish sunshine, which will do so much for bad or indifferent architecture.

The past wealth and importance of Salamanca is well illustrated by the number and the architectural merit of the many private dwellings which still exist; buildings which an Italian would term palaces, but which the Spaniards are content to designate as simple *casas*. The most interesting of these is the famous Casa de las Conchas. [See Illustrations.] A design more thoroughly Spanish could hardly be found anywhere; the Spanish type which knew just when to stop, which concentrated its ornamentation in a few spots; a couple of frost-like iron grilles before the lower windows; a single, wide doorway crowned by a coat-of-arms set in a rich, late Gothic frame; a few tall, mullioned windows, with a little elaboration of tracery in the head, each different from the other, but perfectly harmonious; a flourish of armorial bearings at the angle, and a broad wall, unbroken by the slightest shafting or string-course, but studded all over at regular intervals with boldly-carved conch shells in high relief, emblems of some pious pilgrimage made by the master of the house. In any country but Spain, who would dare do a thing so simple and yet so effective?

The Casa de Maria la Brava is an example of a type which is repeated a number of times in Salamanca; a design which is interesting as showing how a very little work, rightly disposed, can sometimes make a very effective façade, and also as an illustration of the value of a single, broad, round arch, without mouldings or ornament whatever, nothing but good proportions and wide voussoirs. Nowhere else in Spain is the simple, round arch used as effectively as in this city, and there are a number of houses having even less work than the Casa de Maria la Brava, sometimes nothing but the big, round arch and the wide arch-stones, which are full of quiet interest. The Spaniards were never afraid of heavy masonry, and did not hesitate to make the voussoirs even wider than the doorway itself, if they thought an effect was to be gained thereby.

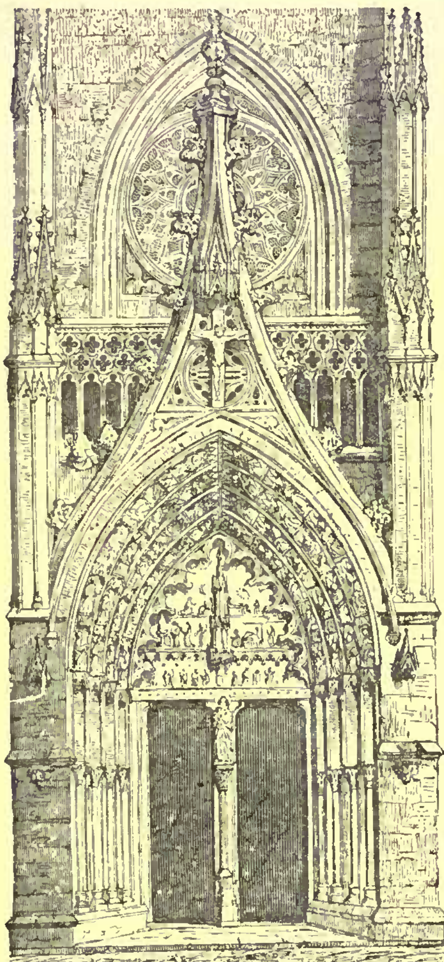
The architectural wealth of Salamanca is fully appreciated by the natives, as well as by the travellers who have had the good fortune to study it. Castalar wanted to make the city the seat of the national architectural academy, which now languishes in bleak, art-less Madrid. Surely no other city of Spain is so well calculated to inspire the student, to give one valuable ideas of good construction as well as of good design, of rich elaboration as well as of effective, studied simplicity, and to one visiting Spain for the first time no better advice can be offered than was given by a leading Madrid architect, a man who knows the country in every detail: leave out Cordova, omit Seville, if you must, but do not fail to study Salamanca.

C. H. Blackall.

Monster Blast of Granite.— Saturday, July 24, was the occasion of one of the periodical blasts which takes place at the granite quarries on Lochfyneside, leased to Messrs. A. and J. Fall, paving contractors, Glasgow. At present two quarries are being worked in the district, one of them being Crarae quarry, near Crarae Pier, and the others being Furnace quarry, between Crarae and Inverary, the seat of the Duke of Argyll. It was at the last-named quarry that the "monster blast" in question took place, the amount of gunpowder employed being 4 tons. An in-going "mine" had been driven to the extent of about 40 feet, and from it there were driven into the rock two diverging chambers or passages to accommodate the powder. The total length of the mining was about 90 feet, the cost of which was about 120*l.* The ignition of the gunpowder was effected by means of an electric dry battery, which was worked in a secluded spot, at a distance of about two hundred yards from the portion of the hillside that was to be erupted. There were a number of workmen's houses in somewhat close proximity to the quarry, and within a short distance of the sea-shore, but they were vacated at the time, the nearest person being the operator of the battery. When the explosion of the powder was effected the whole face of the mountain-side began to move, and the report, which was terrific, loudly reverberated amongst the neighboring hills. It was estimated that the quantity of rock that was removed reached something like 100,000 tons, which will furnish sufficient dressing material to keep the workmen at the quarry employed for the next two years. Another "monster blast" is expected to take place at Crarae quarry toward the end of August. The "head" in this case is being driven 60 feet into the hill-side, and the divergent chambers are to be charged with no less than 7 tons of gunpowder. This system of blasting has now been practised to excellent purpose on Lochfyneside for many years, the originator of it being Mr. William Sim, of Glasgow.—*Engineering.*

AN EDITOR'S TRIP ABROAD.[1]—X.

MUNICH.—NUREMBURG.—FRANKFORT.—COLOGNE.



Doorway of Notre Dame de Lépine France.

Considering the immense amount of money which has been spent at Munich by the last three kings of Bavaria, in what they probably supposed to be the promotion of architecture, it is surprising that their achievements should have had so little influence upon the current building of the city. In most places any important architectural work is soon reflected on all sides in humble imitation of outline or detail, but the costly classicalisms of Klenze and Gärtner stand solitary in the midst of structures as different in design as they could well be. Even the great Grecian group formed by the Glyptothek, the Propylæa and the Exhibition Building, which might have been expected to influence the character of the new quarter which has recently sprung up around it, looks now, surrounded as it is by streets which might have been transferred there bodily from Berlin, stranger than when it stood in almost open ground. It is perhaps fortunate for the people of Munich that matters turned out in that way, as Classical houses would have cost them a good deal more than those built either after the Berlin model or in the picturesque fashion native to the country; but the difference between this total disregard of the brilliant example set by the king's architects, and the rapidity with which Greek classicism, in particular, spread over England at a little earlier date, is curious. It is rather satisfactory, at least, to find that the mode of decorating important structures with exterior frescoes, which was set in the old Pinakothek, is not likely to be followed hereafter. Even now, nothing remains of Kaulbach's great pictures on the front except a few pale patches, which one with difficulty recognizes as having once been connected; and those on the east and west sides, although in much better condition, show signs of approaching dissolution. The two pictures on the north side are still bright, indicating that the sun is here the most efficient agent in destroying the colors; while the painted tympanum of the Residenz Theatre, which faces nearly west, has lost nearly all trace of the fresco from the lower portion, where the westerly rains, joined to the spattering from the horizontal cornice, have been most effective in washing away the surface.

By far the most satisfactory of the royal buildings in Munich, to my mind, was the little Allerheiligen church, where Klenze was allowed to use his classical knowledge and his architectural capacity together, in composing a small church out of the elements of a Roman bath, or, perhaps, with the features of the later basilicas, which were themselves adapted from the bath construction. Nothing could be simpler than the arcade, of two arches only, which supports the low-domed ceiling, or than the way in which two columns in each bay, separating the nave from the aisles, carry the gallery which runs across at the impost line of the great arches; but it would be difficult to imagine anything more architectural, and even without the splendor of the gold which covers nearly everything above the spring of the great arches, the building would be one of the most effective ever erected.

From the wide, pleasant streets and handsome Renaissance buildings of Munich to mediæval Nuremburg is, materially, a very easy step, and half a day is enough to bring the traveller, tired of palaces and classicism, into the shadow of the tower which guards the narrow gate of Albert Dürer's town. Of all the cities in Europe, Nuremburg must certainly be the one where the sketcher finds most occupation. To say nothing of the endless variety of light and shade afforded by the crookedness, narrowness and steepness of the streets, nearly every house differs from every other in the shape of its roof, its gable or its dormers, its bays, or the way in which it is corbelled over the street, while just enough spice, in the shape of the round towers or battlements of the walls, or a bridge, a church-spire or fountain here and there, occurs among the house-fronts to prevent them from ever becoming tiresome. Moreover, to the constant interest of outline and shadow, which might, perhaps, be approached in some other old cities, Nuremburg adds a beauty of detail in which it must stand unrivalled. It would hardly be too much to say that there is not a house, ancient or modern, inside the walls, which does not exhibit some charming bit, either of carved woodwork or of wrought-iron work, or a clever lead water-spout or gargoyle, or some other effective and original device. In ironwork, more especially, the Nuremburgers may claim superiority to the people of any other place. It would not be surprising, in any German town, to find some pieces of wrought-iron of extraordinary excellence, but here all the ironwork is good, and one finds it everywhere. The meanest house will have its cellar door hung with strap-hinges, whose ends are prettily cut and curled, while its more ambitious neighbor will have a grille at the front entrance composed of bars, not only interlacing in pretty patterns, but flowering at the ends into beautiful rosettes, hammered and marked with patterns, which form extremely delicate yet effective spots on the surface of the grating. Some of the work, as, for instance, the entrance-gate to the "Peller House," shows remarkable skill, not only in design, but in the drawing of the profile faces, which, rudely *repoussé* with the hammer to give them substance, adorn it here and there, and the variety and ingenuity displayed in the more modest examples are almost infinite.

In Nuremburg proper, that is, the city within the walls, there are no new buildings of importance, and those in the new suburbs, outside the gates, although pretty in the way of German city houses, and in some cases very handsome and costly, are not otherwise remarkable, so that it was not until we arrived in Frankfort that there was much material for calm criticism. There is more old work left in Frankfort than I had supposed, and many of the streets, lined with houses which advance over the pavement in three or four successive projections before the gable is reached, are picturesque, even after Nuremburg, while some of the carving on the consoles and brackets which support the projections is extremely effective; but most of the buildings in the city date from a comparatively recent period. The more modest of these, although far from showing the elaboration or the picturesqueness of the old ones, are often very clever in their way. Nearly all the roofing is done with slate, and slates are used with an originality which is full of instruction for those who have to treat shingles in a similar way. Among other things, it is very common to give the gables of the narrower houses a sort of Elizabethan profile, and slate the front all over, down to the level of the cornice, or rather, to a string-course a little higher or lower, forming the coping of the gable also with slates, and slating over the window-frames to the very edges of the openings. The slates not being square, but slightly rounded at the ends, gives a very pretty effect, and in many cases other bands and hoods of slate cross the lower part of the house. In roofing, it seemed to be the universal practice to lay the slates diagonally, at an angle of about thirty degrees with the ridge, according to the pitch of the roof, for the sake of dispensing with metal flashings, which were rarely to be seen. In slating up against the sides of the dormers, as the rows of slate approached the intersection of the side of the dormer and the roof at a right angle, it was only necessary to put a furring, of triangular section, in the angle, to enable the roofer to slate continuously from the roof over the furring and diagonally up on the side of the dormer, trimming off the slates when he arrived at the front of the dormer, and, in the same way, the pitch of the dormer roof was arranged at such an angle as to bring the valley between the dormer roof and the main roof parallel with the direction of the courses, so that the overlapping slates followed each other without a break down the roof, and over the dormer to the edge. The first buildings arranged in this way that I noticed were old ones, and the dormers, from which the slates had considerably decayed, had a picturesqueness which was not without a suspicion of leakiness, but on investigating further, in the Sachsenhausen suburb, I found that the same system still seemed to be held in favor.

The modern part of Frankfort, which far surpasses Munich in its air of wealth and civilization, is full of interesting work. The largest of the new buildings, and one of the most beautiful to be found anywhere, is Lucae's Opera-House, which has a splendid situation, at the junction of one of the most important streets with the long, narrow park which nearly encircles the city. Being surrounded by streets on all sides, it has necessarily four fronts, but each front is a highly-studied and elegant composition, and the two ends are of extraordinary richness. By a happy inspiration, variety is given to the work by making the decoration of the ends depend mainly on shadow and sculpture, heightened, in the entrance front, by the gorgeous coloring of the ceiling of the loggia, which, as in Paris, occupies a position over the doors, while the sides, although ornamented with a very rich order of pilasters, receive their main interest from the beautiful sgraffito decoration, in dark-brown and white, with which their panels are filled. This sort of mixed plaster-work

[1] Continued from page 85, No. 556.

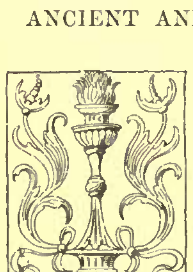
has always seemed to me a dangerous thing to meddle with, and some of the examples that I have seen, by their glaring ugliness, had confirmed me in that idea; but it is used here so boldly and with such admirable skill and success, as certainly to elevate it to a high rank as a means of obtaining architectural effect.

The last German building of special importance which we were to see was, perhaps, the most interesting of all. I did not linger many minutes in Cologne before hastening to see the completed cathedral, and was well rewarded by the first impression of it. Certainly, whatever criticisms may be made in regard to its originality of design, or the merit or demerit of its details, Cologne Cathedral is now the greatest building north of the Alps, if not in the world. Undoubtedly, many of the English cathedrals are more picturesque, and much of the French detail is more interesting, but in neither country is there anything so thoroughly satisfying to the architectural mind as this vast and complete composition. As one stands before it and takes gradually into his mind the nobility of the outline, the skill with which the parts of the enormous spires are held in their due relation to the whole, and the admirable proportion of the entrances, he feels, as he does in the contemplation of none of the mutilated French cathedrals, at least, that, whatever amateurs may say, these are the main things in an architectural composition, and that mere detail is altogether a secondary affair. However, at Cologne, the detail is anything but unworthy of the church. It has often been said to be a French cathedral on German soil, and there is very little of the German interlacing "stump tracery," which Mr. Fergusson used to dislike so much, while most of the cornices, gargoyles and other enriched exterior work would do no discredit to Paris or Amiens. That the sculpture about the doorways is cold, and too much subordinated to the architecture, is perhaps true, but the portals are so beautiful in their lines, and in the play of light on the carved mouldings, that one is easily reconciled to a little lack of originality or "phonetic" quality.

Inside, however, the lack of originality of the exterior is certainly made up by the happy idea of placing statues at the foot of the vaulting-shafts. The interiors of French cathedrals are generally uninteresting, as compared with the exterior, and the architect of Cologne, if he had been content with copying, might well have been satisfied with the elegance of proportion which he had succeeded in securing; but he seems to have felt the need of some movement and interest near the base of his piers, and, by placing his statues against them, he not only obtained an admirable richness and solidity of perspective effect just where all French cathedrals lack them, but added much, it seemed to me, to the lightness and apparent height of the ceiling. If he had used the statues with less discretion, as, for instance, at Milan, where they are plastered in lumps around the piers, they would have done more harm than good, and in the photographs of Cologne they appear at least of questionable value, but in the real building they are exactly right, just large enough and just high enough to give the effect desired.

ANCIENT AND MODERN LIGHT-HOUSES.[1] — II.

TOWER OF CORDOUAN.



PANEL ORNAMENT
on Tomb in Cathedral,
Amiens, France

IT is to Monsieur Belidor, Colonel of Infantry, Chevalier of the Military Order of St. Louis, etc., that we are indebted for the best description of the Tower of Cordouan. The following account is taken from his "*Architecture Hydraulique*," published in 1777, "with the approbation and privilege of the King." He says:

"Since the superb light-houses built by the ancients, there has not appeared one more august nor of more importance than the famous Tower of Cordouan, located on a rock in the sea at the mouth of the Gironde, to aid the entrance and exit of vessels in the two rivers, Garonne and Dordogne, whose confluence forms the Gironde. Without this tower many vessels would be wrecked. It serves as a beacon during the day and a light at night, to guide the ships, and to prevent them from running on the reefs, which are numerous in the vicinity. There are but two passes, the one called *le pas des anes*, between Saintonge and the tower of Cordouan, and the other between the same tower and Medoc, named *le pas de grane*, both equally dangerous.

"The tower is about two leagues from Bordeaux, and the rock on which it is built is 500 toises in length from north to south, and 250 toises in width from east to west. The sea, in its vicinity, is filled with sunken reefs, covered with three or four feet of water, against which the waves break with great fury, making the access to the tower extremely difficult.

"This magnificent tower, rising 169 feet above its base, was commenced in 1584, during the reign of Henry II, by Louis de Foix, a celebrated French architect, and finished under Henry IV, in 1610. Sailors deem this light-house the finest in Europe, not knowing any other more magnificent, or as bold in construction. As can be seen by the plan of the tower, there is a platform, surrounded by a circular wall, against which are the various buildings for the residence of the four keepers and for the storage of supplies; the latter contains six months' provisions, and there is a fine cistern for catching an ample supply of water from the tower. In the centre of the platform is the basement floor, containing a large room, two closets, and small room. Underneath are the cellars and the cistern. The first floor, which is called the King's Appartment, comprises a vestibule, closets, and other conveniences. The second story is occupied by a chapel, where mass was said when the weather permitted a priest to land. In this chapel were the busts of Louis XIV, and of Louis XV, placed there in 1735, with a grand Latin inscription containing a condensed history of the tower. There is also a bust of Louis de Foix, over which is the following inscription in a large frame:

"'Qvand iadmire ravi cest œvvre en mon covrage
Mon de Foix mon esprit est en estonnement,
Porte dans les pensers de mon intendement
Le gentil ingénievx de ce svperbe ovvrage
La il discovrt en lvy et dvn mvet langage
Te va lovant svbtil en ce point mesmement
Qve tv brides les flots dv grondevx element
Et dv mvtin Neptvn la tempeste et l'orage
O trois qvatre fois bienhevrevx ton esprit
De ce qv'au fronte dressé ce phare il entreprit
Povr se perpetver dans l'hevrevse mémoire
Tv t'er acqvis par là honnevr infini
Qvi ne finira point qve ce phare de gloire
Le monde finissant ne le rende finez.'

"A description is unnecessary of the beautiful architecture which forms the interior and exterior decoration, it being easy to judge of it from the section and elevation. I will only add that the arms of France are on the front of the first story, accompanied by two statues, one representing Mars with his ordinary attributes, the other a female figure holding a palm in one hand and a diadem in the other. Lower are two niches: in the right-hand one is the bust of Henry II, and in the other the bust of Henry IV. The portico is opposite the entrance to the platform; on the opposite side is the staircase, partly built in the thickness of the wall, and partly outside.

"For more than a century this tower was the admiration of all connoisseurs, but at length, the heat of the fire having injured the walls of the lantern, the Court, in 1717, ordered that it be demolished, to prevent its falling, and that the light be established below it, instead of repairing the damaged parts, and keeping the light at the same height. It was not long before it was seen what a mistake this was, for the lantern had no sooner been taken away than all the sailors complained that the light could not be seen at a distance of two leagues, as was formerly the case.

"Things were in this state when, in 1720, the tower passed from the jurisdiction of Rochelle to that of Bordeaux. Then the Count of Toulouse, Admiral of France, and Marshal Asfeld, Director of Fortifications, entrusted the reparation of the tower to Monsieur de Bitre, Engineer-in-Chief of Bordeaux, who sought the means of rëestablishing the light at its former height by a lantern which should not intercept the light to the same extent as the old one. He accomplished this by building an iron lantern, as shown in the plate. This was successfully placed in 1727. The brazier for burning the fuel held two hundred and twenty-five pounds of coal, which was lighted at sunset, and burned all night. The old brazier was too small. Oak wood was burned in it; the flame was large, but it had to be replenished every three hours. The height of the new lantern was greater than the old one, so that the tower was increased in height to 175 feet from its base to the weather-cock."

This elevation was not sufficient to enable mariners to see the light at a very great distance, so Teulère, Engineer-in-Chief of the district of Bordeaux, performed the difficult task of raising it, at the end of the last century. The height was increased to 197 feet above high tide, giving a great increase to the range, but marring its architectural beauty, as the absence of ornament in the modern part contrasts painfully with the elegance and richness of the work of the Renaissance. The first impression of the tower, however, is still very striking, rising as it does with such majesty and boldness from the bosom of the sea.

About thirty years ago, this light-house was completely renovated, many of the stones, worn by time, were replaced, and the carvings, which had become almost indistinguishable, were recut; it now contains in its lantern, in place of the old oak or coal fire, that nearly faultless piece of apparatus known as the Fresnel lens, by means of which all the light possible is utilized in strengthening the friendly beam.

THE ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

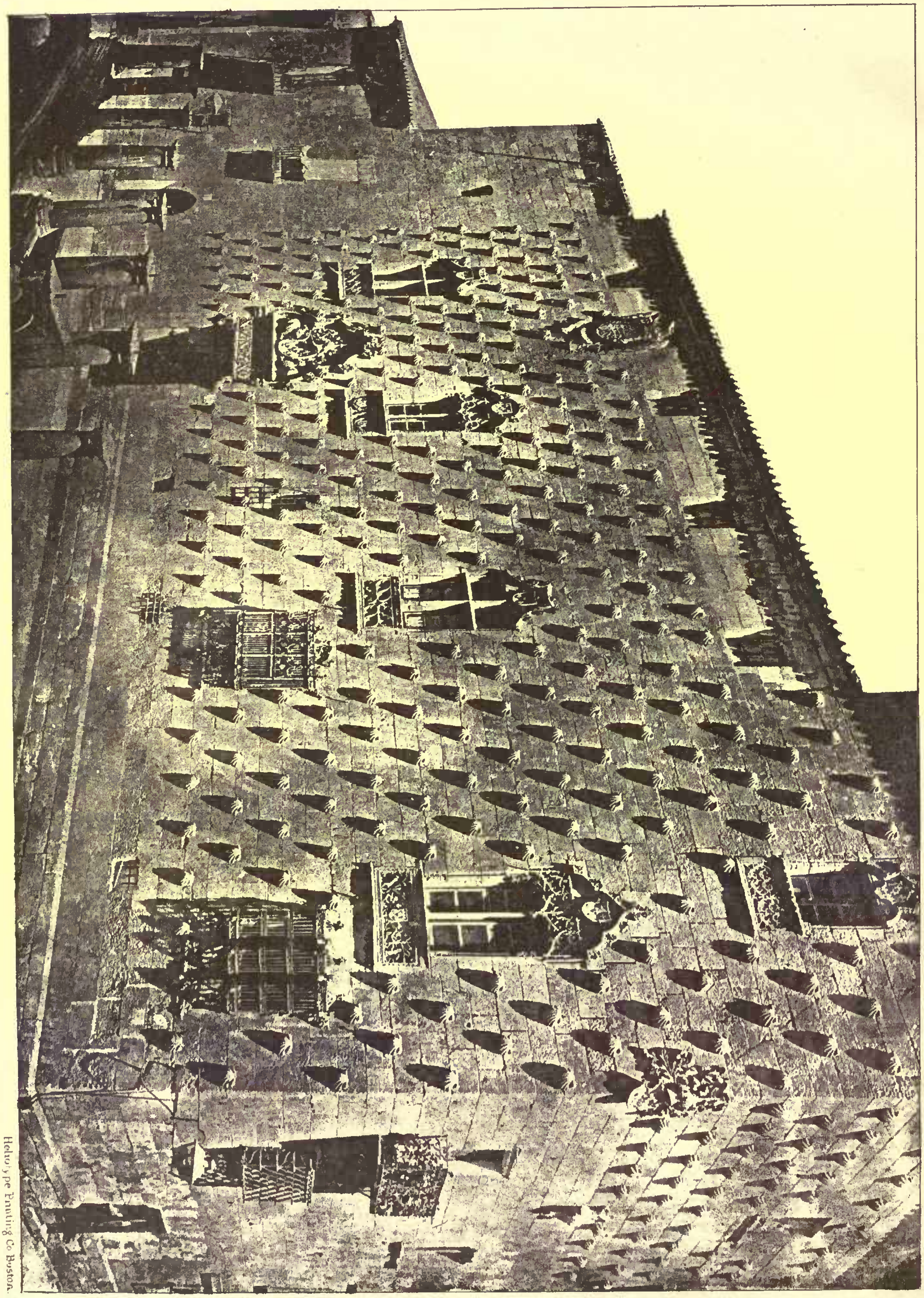
THE LENOX LIBRARY, NEW YORK, N. Y. MR. R. M. HUNT, ARCHITECT, NEW YORK, N. Y.

[Gelatine print issued only with the Imperial and Gelatine editions.]

[1] Continued from page 16, No. 550.

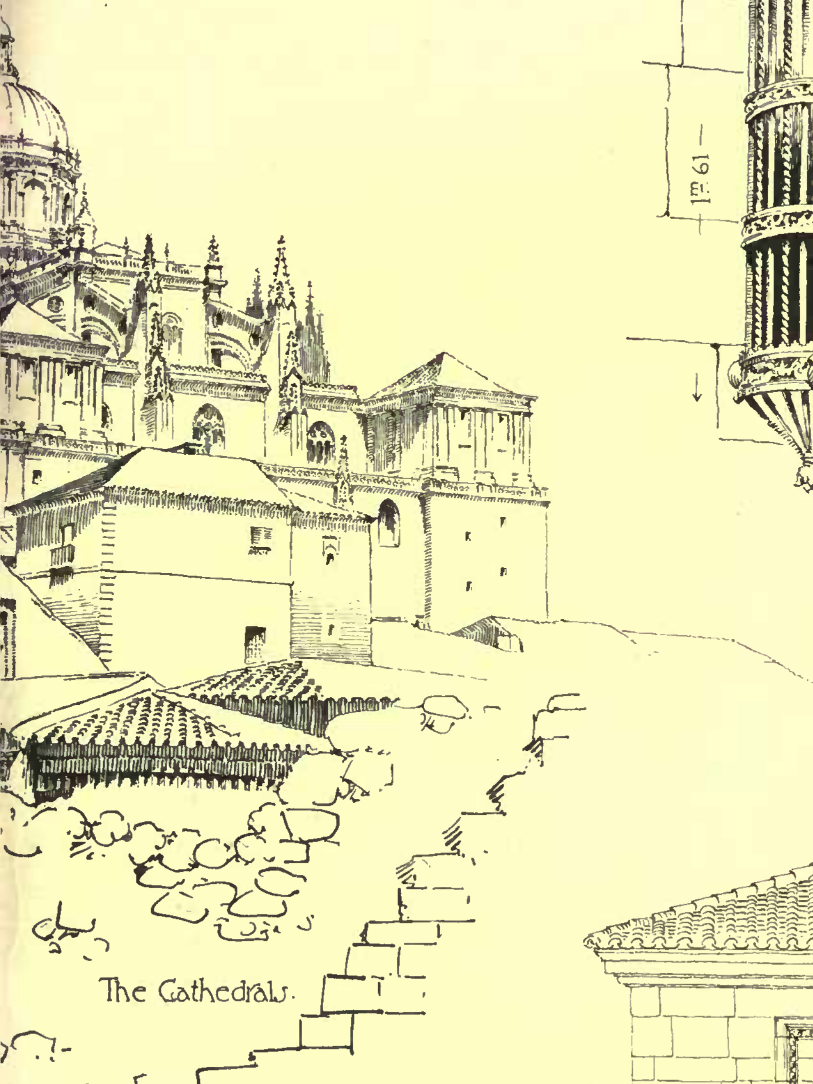


Heliotype Printing Co Boston.

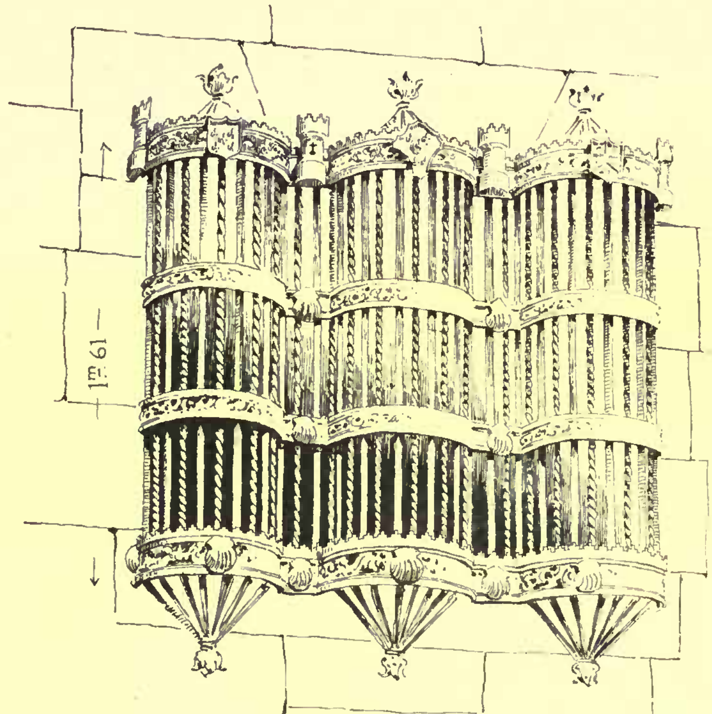


Heliotype Printing Co. Boston.


Sancti Spiritus.
Sketches from
SALAMA
by C·H·Blac
Deta
about 2 metres
Cornice.
From San Justo.



The Cathedrals.



Wrought Iron Grille —
Casa de Conchas —

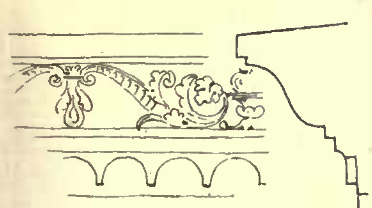
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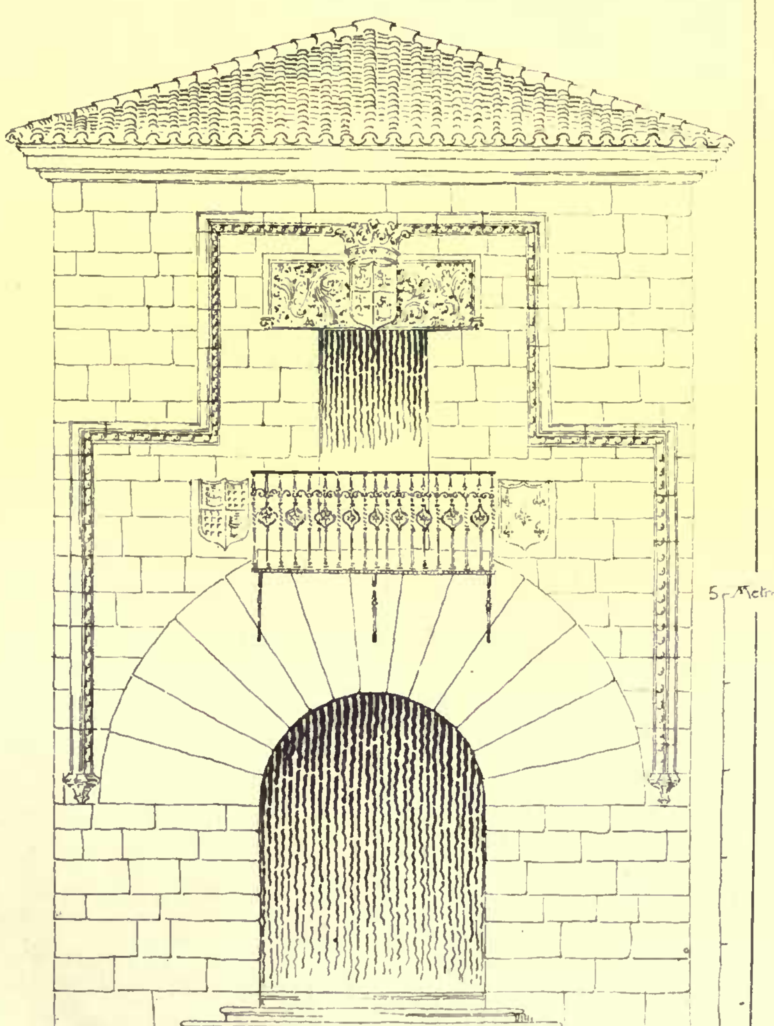


Cornice from
the 'Instituto.

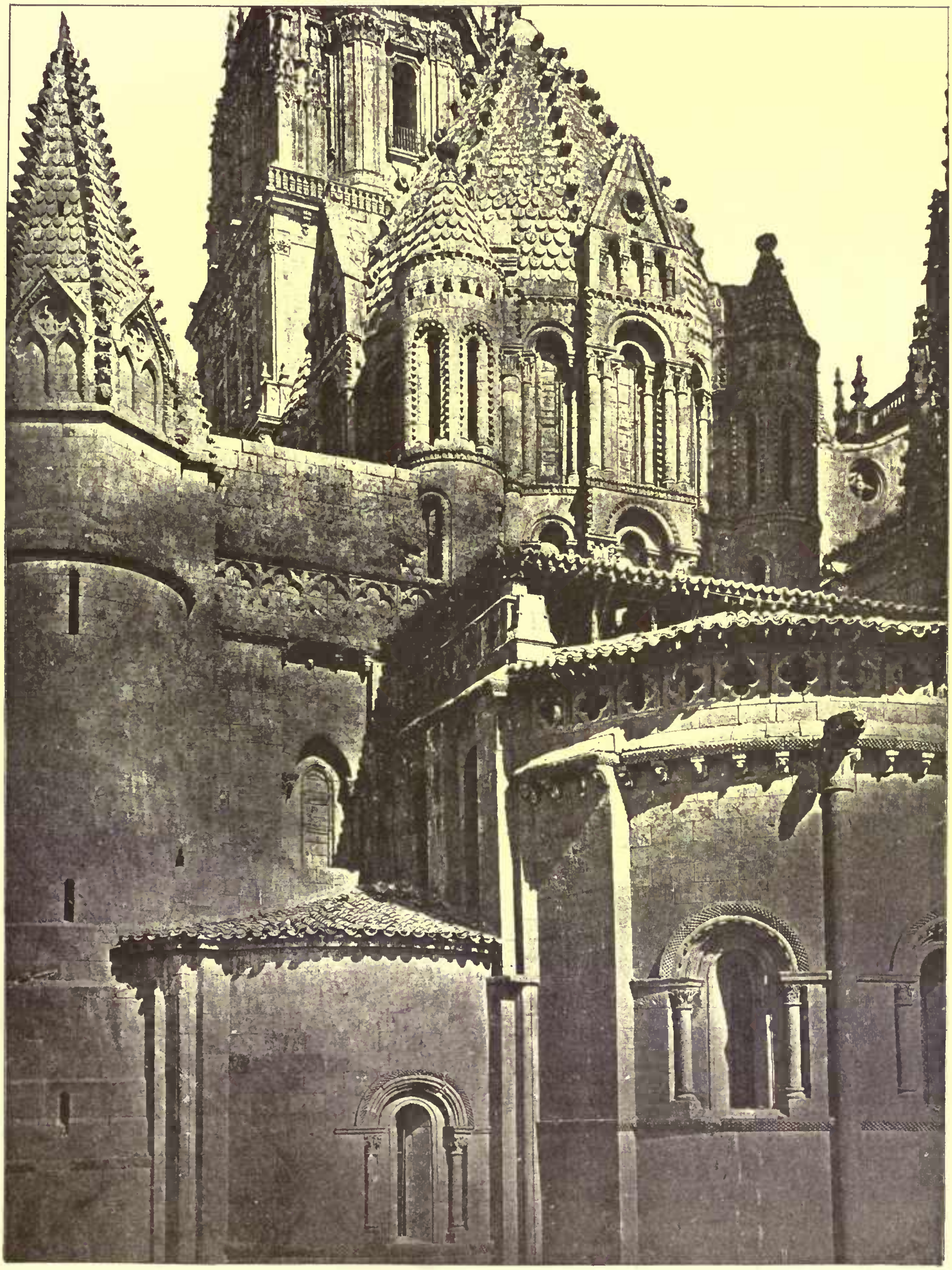
om the
de las Muertes.



Belt Course.



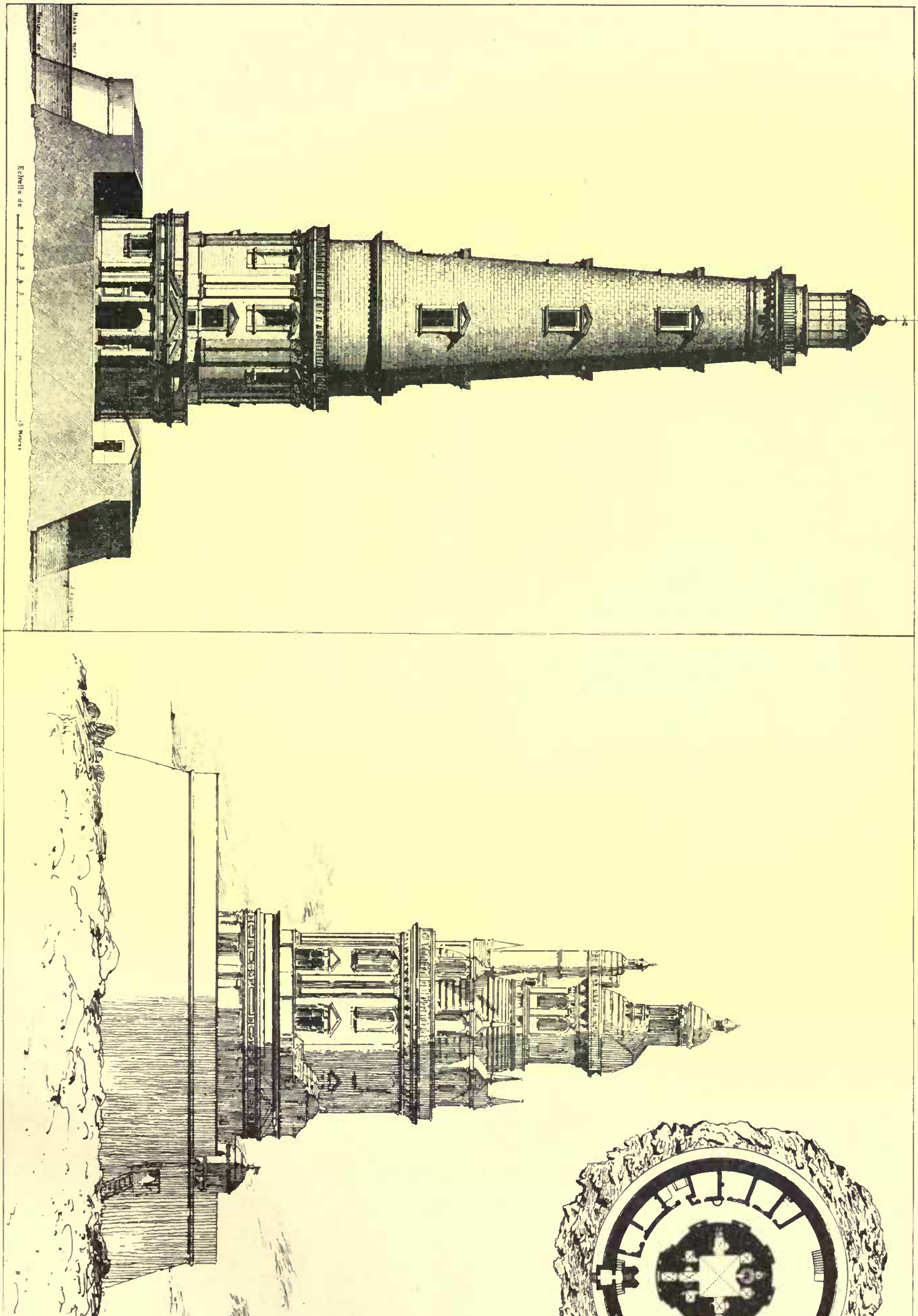
Casa de Donna Maria la Brava.

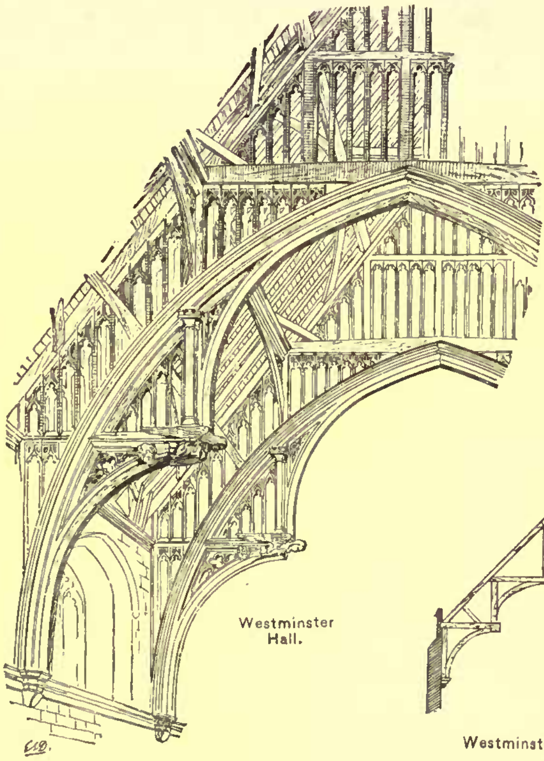


Heliotype Printing Co Boston

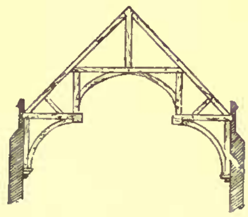
The Cathedral, Salamanca, Spain.

Modern — Tower of Cordouan — Ancient

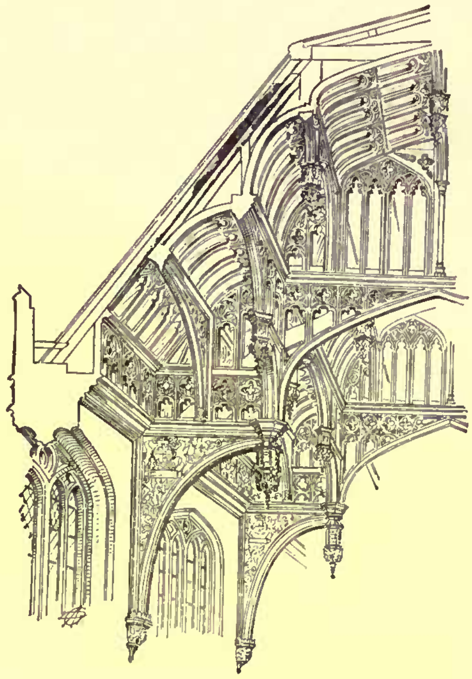




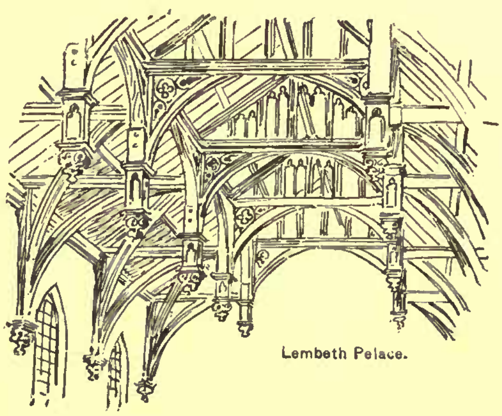
Westminster Hall.



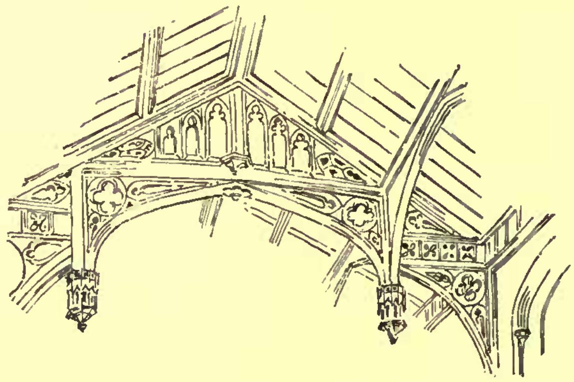
Westminster School.



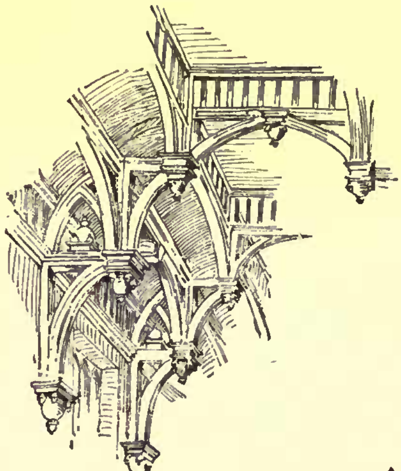
Hampton Court Palace.



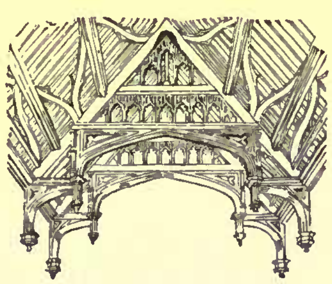
Lembeth Pelace.



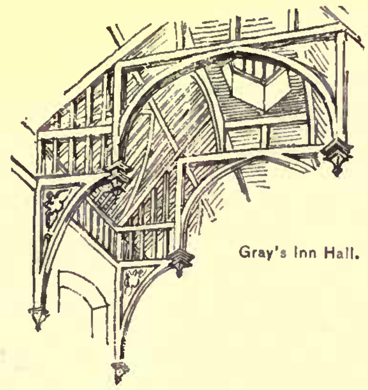
Christ Church, Oxford, England.



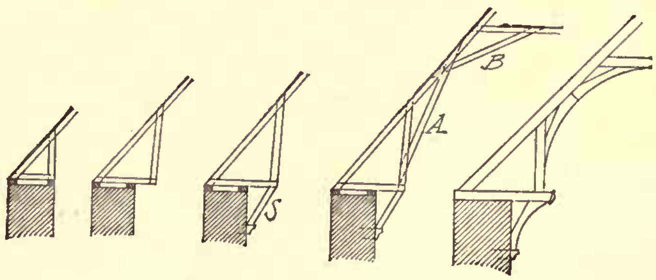
Middle Templa Hall.



Eltham Palace Hall.



Gray's Inn Hall.



Tha Genesis of the Hammer-beam Truss.

Open Timber Roofs.

"THE ROCK." HOUSE OF DR. C. T. GARDNER, SAKONNET POINT, R. I. MESSRS. STONE, CARPENTER & WILLSON, ARCHITECTS, PROVIDENCE, R. I.

THE LIGHT-HOUSE OF CORDOUAN, FRANCE. ITS ANCIENT AND ITS PRESENT APPEARANCE.

FOR description see article on "Ancient and Modern Light-Houses."

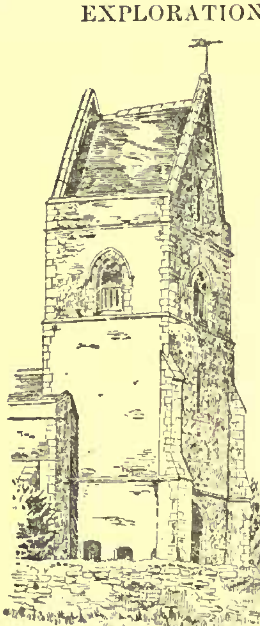
SKETCHES AT SALAMANCA, SPAIN, BY MR. C. H. BLACKALL, ARCHITECT.

FOR description see "Notes of Travel," elsewhere in this issue.

THE CATHEDRAL TOWER, SALAMANCA, SPAIN.

THE CASA DE LAS CONCHAS, SALAMANCA, SPAIN.

EXPLORATIONS IN THE OHIO VALLEY.



Tower of Old Church, Maidford. After Sketch by Thos Garratt Eng.

THE valley of the Ohio River is one of the most prosperous sections of the United States, and when we speak of the marvelous development of our country, we are accustomed to point to this region as an example thereof; a region now teeming with a prosperous population, where, hardly more than a century ago, there was a wilderness, inhabited by only a few savage tribes. Yet there is evidence to show that there was a time in the unknown past, when the same land was peopled as densely as it is to-day, perhaps even more densely, if the great cities of to-day should not be taken into account. Not only is there evidence of the occupation of that great and bounteous valley by one people, but by various peoples, during the many centuries which have elapsed since the man of the glacial period lost his rude implements of flint in the glacial gravel. How many distinct epochs of occupation there have been it is yet hardly possible to say, though there appears to be a good prospect that much light will be thrown on the subject when the results of important investigations now in progress are determined, and opportunity is given to compare them and draw conclusions therefrom. It may be said, however, that upon one spot, a small district in the valley of the Little Miami River in Ohio, near the town of Madisonville, proofs of various distinct occupations have been found, showing at least three different peoples. The first of these carries us back thousands of years before the glacial period that covered the land north of the Ohio River with a vast sheet of ice, thick enough to cover the tops of many a high hill in New England. The proof of this is in chipped stone implements like those discovered by Dr. Abbott in the Trenton gravels in the Delaware Valley, and like others found in the Minnesota gravels of the Mississippi Valley, all of them of the same character as those brought to light in the river-drift deposits of Europe, and showing the antiquity of man on this continent to be as great as on the Eastern.

The investigations of this region have been conducted by Mr. F. W. Putnam, the curator of the Peabody Museum of American Archæology and Ethnology at Cambridge, and Dr. C. L. Metz, of Madisonville, Ohio, and they rank as the most important archæological exploration ever carried out in North America, being unapproached in thoroughness and scientific method. The usual way of conducting so-called explorations has been to dig at hap-hazard into a mound or any other spot, and take out whatever happened to be interesting. The things thus obtained, while valuable as "curiosities," lose much of their scientific worth from the fact that little is known of their surroundings. This slipshod custom has even been pursued by eminent scientific institutions which should have known better. The aim of Professor Putnam, with the earnest co-operation of Dr. Metz, has been to obtain the most exact data of the situation and circumstances, affording by the accuracy of the record of every stage of the work material for a complete history thereof. Therefore, when at any time the facts are to be inquired into there is nothing to be left to assumption or guess-work. First, there is a topographical survey made of the ground to be explored. It is then marked off into blocks and sections, and taken up section by section. A trench is dug across a section, through the leaf-mold down to the hard-pan, and the excavations then continued down to the same depth, keeping a uniform face-wall in front all the time, and throwing the earth behind, thus filling up again the space excavated as the work advances. In this way every inch of the earth in which remains of any kind are likely to be found is carefully examined.

When anything of importance is encountered, notes are made of its exact position, photographs are taken, and then the earth is carefully removed from around the object with a small trowel and a brush. If it be a mound which is being explored, it is sliced away vertically in the same way; accurate measurements are made of the sections at frequent intervals, scale-drawings are made and photographs are taken. Detailed memoranda are made of everything found, specimens of each kind of earth, stone, etc., are preserved, and the earth is carefully sifted wherever there are traces of anything, that not even minute objects may be lost. In short, nothing which by any possibility could throw light on the history of the subject of investigation is lost sight of.

An exceedingly interesting volume could be written about the results of these explorations already accomplished in Ohio. They began in 1881, but have been suspended at intervals on account of lack of funds. Professor Putnam had previously made some important explorations in the Cumberland Valley, in Tennessee; and his attention was drawn particularly to the Little Miami through the exceptional interest felt in the remains of the vicinity by a number of gentlemen in Madisonville of scientific tastes, among them Dr. C. L. Metz, who has been Professor Putnam's most valued assistant in this work, and has superintended it during his absence.

The first subject of exploration was an ancient cemetery, occupying fifteen acres or more of an extensive plateau, still covered in places with large trees of what is called the primeval forest. These trees, and the twelve to eighteen inches of leaf-mold overlying the hard-pan, showed that at least four hundred years must have elapsed since the burials took place. Over sixteen hundred skeletons have been found in this cemetery, generally from a depth of two or three feet, together with many implements and utensils.

A most remarkable feature of this spot, however, are the singular "ash pits," of which over a thousand were discovered. These were probably connected with the burials above them, but before these pits were made, the place had been used as a cemetery, as was shown by the finding of a number of the skeletons buried prior to digging the pits.

The purpose of the pits still seems to be a mystery, though several theories have been advanced. The pits are circular excavations in the hard-pan, three to four feet in diameter, and four to seven feet deep from the surface of the leaf-mold. The average pit was filled with ashes in more or less defined layers. Bones of fishes, reptiles, birds and mammals, shells and pieces of pottery, together with a large number of implements made of stone, and bones of deer and elk antlers were found. All the implements found here, or in the remains of any aboriginal American people, have their likes among the implements of primitive people in other parts of the world, with the single exception of one tool used by the people who dug these pits. This is made from the leg bone of a deer or some other large animal, longitudinally grooved, with sharp edges bevelled on the inside, and probably used as a scraper of some kind. Large numbers of these were found. Examination of several earth circles up the hill near the cemetery, forty-three to fifty-eight feet in diameter, shows them to be the sites of the dwellings of the people who made the pits, for the remains of utensils, etc., found there agreed with those in the pits. These dwellings were probably similar to the lodges of the Mandans and other Indians. Professor Putnam thinks that possibly on special occasions all the articles in the house, with ornaments, implements and other personal objects, were partially destroyed by fire, and the remnants gathered up with the ashes, and deposited in the pits dug for the purpose, while the broken bones, etc., indicate that feasts were held on such occasions. This might correspond, perhaps, with the custom of the Aztecs of destroying all their household utensils at the end of their fifty-two years' cycle, and beginning the new cycle with a fresh start.

The most remarkable and interesting results, however, have been obtained from the excavation of the earthworks known as the "Turner Group," in the northeastern part of Anderson Township, on the estate of Mr. Michael Turner. The group consists of thirteen mounds and two earth circles, the whole enclosed by two circular embankments connected by a graded way. This group is believed to be the work of the race that built the great earthworks in Ohio. Several of these mounds were called "altar mounds" from the fact of their covering "altars" or basins of burnt clay, two of which contained thousands of objects of rare archæological interest. These objects throw much light on the character of the people who built the mounds. The manner in which the mounds were constructed indicates that the population was large, and together with their contents, that the race was advanced to a stage of barbarism similar to that of the Pueblo Indians of the Southwest. They must have also been a people of considerable wealth, judging by the value and number of the articles they sacrificed upon the altars, while the extent of country from which these articles came, reaching from the Great Lakes to the Gulf of Mexico, and from the Atlantic Ocean to the Rocky Mountains, and perhaps beyond, gives evidence of the considerable commerce which they must have carried on. The greater number of the objects having been cast upon the fires were badly injured by the heat, and in many instances broken into small fragments, but some of the articles were preserved intact by getting covered by the ashes. Two of the altars, each about four feet square, were cut out and brought to the museum and the entire contents of two have been preserved, even to the ashes. The condition of the altar as it was found is, therefore, excellently illustrated: all the objects have been classified and arranged in separate drawers preparatory to final exhibition according to the admirable system which Professor Putman has devised for the museum. The smaller articles

were secured by thoroughly sifting the ashes and earth. One curious fact discovered was that this ancient people were acquainted with the properties of coal, some pieces of partially consumed bituminous coal having been found upon the altar. It is probable, however, that they did not get it by mining, but picked up pieces along the river from the outcroppings of the banks, as all the pieces are water-worn. The abundance of timber naturally made the use of coal needless.

Among the objects from the altars were found numerous ornaments and carvings unlike anything encountered before. This one altar contained about two bushels of various ornaments of stone, copper, shells, the canine teeth of bears and other animals, and over sixty thousand pearls. Nearly all these objects are perforated for suspension. The pearls are particularly interesting. They probably came from the fresh-water clams of the neighboring streams. Many were large and would still have much intrinsic value, had they not been injured by the fire. A few, however, wholly escaped injury. Ornaments of silver, copper and gold are made of native metal hammered out, there being no indications of smelting. Silver and gold were beaten out into thin sheets and folded over the copper ornaments, suggesting the rudiments of the art of plating. The silver and copper seem to have come from the neighborhood of Lake Superior and perhaps the gold came from Georgia. This is the first time native gold has been found in the mounds anywhere in this country, and the small quantity found here shows that its use was exceptional, but one small copper pendant seeming to have been covered with a thin sheet of gold, a portion of which still adhered, while other bits were found in the mass.

The most important discovery, however, was the several masses of meteoric iron and the ornaments made therefrom. This, containing nickel, was susceptible of a high polish, and was accordingly valued for ornamental purposes. This brilliancy would last as long as the iron was not exposed to moisture or to the great heat on the altar, causing it to oxidize. Several of the ornaments are covered with a thin plating of the iron after the manner in which the others were covered with silver. A number of objects of mica, cut out of large sheets, probably from North Carolina, were found thoroughly preserved. This mica was made into curious ornamental shapes.

Another highly interesting and valuable find from the altar of another mound of the group consisted of terra-cotta figurines and two elaborate dishes in the shape of animals carved out of a reddish slaty stone. These objects were badly burned, and broken and splintered by the heat. Some have been, however, by dint of remarkable patience and skill completely restored, and good progress has been made on others. Some of the figurines have something of an Egyptian type of face and bear also some resemblance to faces carved on ruins of Central America and Mexico, such as the Palenque cross. Their finish is of a higher character than most of the work of aboriginal races in this country. There is no reason to doubt that they were the work of the people who built this group of mounds and in some way, at least conventionally portrayed them, for the ear ornaments correspond with certain singular spool-shaped ornaments found on the altar previously mentioned. The figures show peculiar methods of wearing the hair and curious head-dresses. The dishes are elaborately and smoothly finished. One of them, in the shape of a fish, has certain conventionalized characteristics which are difficult to trace in any American fish. Whence arose this conventionalized form and what relation does it indicate? The conjecture might be hazarded that it is a type of ornament handed down by tradition from a time when the race lived in some other part of the world. The resemblance between certain American races, as shown by their art remains, and the Egyptians is in some particulars so near that many persons have formed a habit of tracing connections which are hardly warranted by facts so far as known. Still, no one can say there was not a connection and possibly it may be established some day.

A peculiar form of ceremonial is indicated by the fact that on the same altar, together with several hundred quartz pebbles from the river, there were nearly three hundred astragals of deer and elk, bones of which but two could be obtained from a single animal, and with them were but one or two fragments of other bones.

The most interesting of all the mounds of this group, and one of the most notable ever excavated, was constructed after what seems to have been an elaborate formula, a description of which would occupy more space than can here be given. In brief, it may be said to have been built over an altar, whose two layers of burnt clay showed that it had been used for a long time. Above this, the mound was composed of layers of burnt clay, sand, gravel and various kinds of earth, all respectively arranged in regular and even layers. Under the burned clay was a strange series of thirty-seven pits, about three feet in diameter and four to nine deep connected with tunnels or tubes eight feet long and a foot in diameter, having a slight dip downward from the pit, and ending in a small vertical tube extending to the layer of concrete or gravel above the burned clay. The walls of some of these pits showed great heat. What their use may have been can not yet be conjectured.

This is but a small portion of the work which has been accomplished in this region by Professor Putman, with an outlay of but a few thousand dollars subscribed by some friends of the museum, the institution having no fund large enough to enable the prosecution of such work. It is doubtful if another instance could be found of an archæological exploration conducted with such economy of means and with such splendid results. Professor Putnam has wisely decided to make the thorough exploration of the Ohio aboriginal remains his principal life-work, instead of making desultory excursions over the country at large. He has therefore marked off a field of labor occupying a space something like a quadrangle, extending north of the Ohio River, with its base on that stream extending from the Little Miami near Cincinnati eastward to Portsmouth.

This space includes many of the most important remains in Ohio, among them the famous "Fort Ancient," "Fort Hill," and the great "Serpent Mound." Professor Putnam is particularly solicitous that these magnificent monuments of the occupation of this continent by man unknown ages ago should be preserved and thinks the pride of the great State of Ohio in possessing these treasures of antiquity should be sufficient to induce the Legislature to make the small appropriation which would insure their preservation as long as our civilization might last. But as there seems little hope of that, could not this be secured and put under the perpetual care of the Peabody Museum, which is for the benefit of the whole country and not a local institution? Fort Ancient, particularly, is one of the great wonders of the world and scholarly tourists from Europe rank it with Niagara and the Mammoth Cave among the sights which they must see. It has a wall nearly five miles around and was evidently once a fortified town. Professor Putnam thus writes of a visit to it:

"Although it has withstood the elements for untold centuries, it is falling before the American farmer with his all-destroying plow, his herds of cattle and droves of swine. The immense embankments, from twelve to twenty feet in height, and sixty or more in width, are now gradually being undermined. Along their summits a fence has been built, by the side of which the cattle have worn a deep path, and from this, after every rain, flow hundreds of little rills, which are slowly but surely washing the earth from the top to the bottom of the steep banks. Here and there, also, a ditch has been cut to drain the fields inclosed, which every spring cuts deeper and deeper into the ancient walls. After fully appreciating the immensity of this structure, and realizing the enormous amount of human labor which was bestowed centuries ago upon these ancient walls and the mounds which they inclose, it was with a sigh that I turned away, feeling myself powerless to save so important a monument of the past for the wonder and admiration of future generations. It would require but a few thousand dollars to secure this grand old work, and with little expense the recently-destroyed portions could be restored and nature be induced again to furnish her protecting coat of verdure, and with slight care from coming generations, this achievement of an unknown people would be preserved for all time to come. If the museum should be the medium for accomplishing this desirable result, and Fort Ancient should be preserved and brought under its charge, it would, undoubtedly, be carrying out in the broadest sense one of the objects for which it was founded — the preservation of American antiquities."

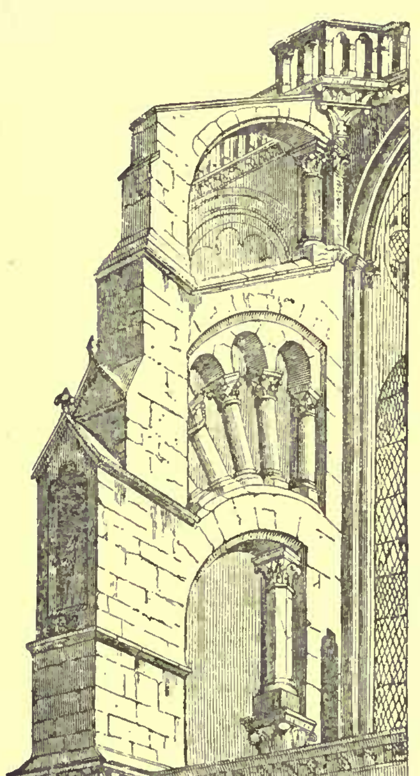
The museum has also been the means of bringing to light two other important facts relating to the remote past of man on this continent. Both of these are due to the explorations in Central America, conducted for the museum by Dr. Earl Flint, who made extensive collections for over six years in Nicaragua. There are now in the museum four imprints of human feet in volcanic rock, fourteen or fifteen feet below the bottom of the surface soil, about three hundred feet west from the present shore of Lake Managua. The foot-prints were immediately below a bed of clay and volcanic material containing fossil leaves, and over this are four distinct beds of volcanic material. The age of these imprints has not yet been determined, but they undoubtedly were made long before historic times.

Among the objects received from Dr. Flint were several fine ornaments of jadeite. One of these ornaments was a celt, or axe, elaborately carved, and others were smaller instruments, made of halves, thirds and quarters of celts, and perforated at one end for suspension. This cutting of celts was discovered by Professor Putnam, who, on examining them, found a portion of the cutting edge of the celt remaining on each piece. Two of the specimens fit together to make half a celt, which had been perforated in the centre of the upper end. When this half celt was again cut, a portion of the original perforation was left on each piece. Now there is no locality known on this continent where the jadeite has been found. If the material had been obtained from a locality within easy reach of the ancient people of Central America, says Professor Putnam, it would not have been considered so valuable, and they would not have spent so much time and labor in cutting up useful and highly-polished implements if they could have obtained the stone in the rough. Moreover, the stone of the Central American specimens has been analyzed by Mr. Oliver W. Huntington, instructor in mineralogy in Harvard University, who pronounced them to be unquestionably Chinese jade, having all the characters of that mineral. This, then, is excellent evidence of there having been intercourse between the people of Central America and those of Asia, probably in very ancient times, and Professor Putnam is of the opinion that the stone may have been brought to this country in the shape of implements by early invaders from Asia, and that, as the supply was not kept up, and most likely even its source became unknown, the pieces among the people were cut and recut and preserved as sacred relics of the past, to be, one after the other, finally buried with their owners. Therefore, this seems to be one of the most important facts yet known, tending to show that the implements were brought from Asia by their original possessors, and that at least one portion of America was settled from that continent.

It is desired now to obtain by subscription the means which will enable this work of exploration in the Ohio Valley to be prosecuted

this season, and to be continued after on a systematic plan for several years to come. It is also hoped, at the forthcoming two hundred and fiftieth anniversary of Harvard University, of which the Peabody Museum is a part, when efforts are to be made to secure handsome endowments for departments that need them, that the wants of the museum will not be forgotten, and that it will be afforded the means to carry out the work of archæological exploration for which it is so admirably fitted, and worthily to house and care for the collections it may obtain. Now is the time for archæological work in America, and splendid opportunities for the securing of priceless results are rapidly passing away. American efforts at excavations in the Old World have an amateurish aspect; Europe is caring amply for that work, and American soil offers a grand field for American endeavor.—*Boston Herald.*

UNDISCOVERED BOHEMIA.



FLYING BUTTRESS, CHARTRES CATHEDRAL.

THE desire of travellers, as distinguished from tourists, to find some spots beyond the sound of the tramp of autumn tripper, has not yet led even this class of European wanderers to penetrate into the fascinating circle of plateaux that are overshadowed by the Iser and Giant Mountains, and the Lusatian Hills. Here the inns are all still of the class where the traveller may take his ease, nor dread the onslaught to be made upon his pockets. Humble and unsophisticated ease it may be, but the ease that is so delightful after a mountain trudge amidst strange forms of rocks, that hold one entranced by their curious and picturesque groups, or after a climb to some robber's nest perched high up on some isolated mountain peak. No Oberkellner troubles you with eye-to-tip civilities. Mine host or hostess welcomes you as you enter, and if the rooms be but sparsely furnished, they are clean (except in the purely Cech towns), and the mountain air is as invigorating as that of the lower Alps. The especial district referred to at present is crossed by no railways, but has been encircled by them of late years; yet still the district, with all its inviting treasures for the naturalist, or the historian or archæologist, remains unvisited by the Englishman.

This narrow district is entirely shut in by mountains, with the exception of the open plain that stretches southwards and Pragwards; and in this direction solitary peaks start up that acted in the Middle Ages as sentinels over this fertile plain that led to the capital. At most of the larger towns a carriage and a good pair of horses can be obtained at a very reasonable rate; but the distance from each separate point of interest is within the pedestrian's reach, and when the traveller has ascended one peak he will quickly find that the whole district teems with interest, and if he is to be moved by any of the objects that usually delight travellers, he may even be moved to excitement at the prospect stretched before him.

The mountain peaks here are not as other mountain peaks. Unlike the heights in the Rhine district, they tempt one to the ascent, not simply from the fact that a glorious view is to be obtained from their summits, but also by their own peculiar formation. Like the hills and mountains in Saxon Switzerland, the forms they have assumed surprise and astonish; and as the dark lower pine forests at their bases are entered, the solitary giant pillars of grey and yellow sandstone oftentimes spring up on every hand, and detain the traveller as he climbs the height, to wonder at their fantastic formation. Here and there entrances are seen into the mountain side, and great caves may be explored that formed the peasants' stronghold in the days of "Fist-right."

It is not often necessary to take a guide through these solitudes. Of course there are no guides such as the Swiss tourist would understand, though a boy may be found perhaps at the nearest cluster of houses who, for a few kreutzers, will show the nearest cut to the top of the mountain; but the mountains being isolated, generally the widest ascending wood-cutter's path leads to the summit; and, frequently as the forest is entered, the most picturesque wood-cutter groups may be seen encamped where their work of cutting and stacking, and branching the lesser timber detains them.

The peasant women throughout the district wear at all times the brightest colors, so that these groups often contain women forms dressed in light pink, blue, grey, primrose and other colors dotted about amidst the stacks of newly-cut timber. A rough hut of logs perhaps has been erected for their shelter, at the door of which streams up the pillar of blue smoke from the fire that warms the coffee of these poor toilers, whose pay perchance amounts to three or four shillings per week. As the hill is ascended, sometimes little knots of three or four wood-cutters are met bearing or sledging their stacks of timber; one man perhaps is with them, and two or three women, each dressed in a different but bright-colored dress, and wearing on their heads handkerchiefs of still more brilliant hues. These groups suddenly appearing amidst the unending vista of the pine trunks, have a most striking and even theatrical effect; and perhaps just as the traveller is beginning to wonder when he will reach the summit, or at least see some traces of the castle whose ruins he has been told still top the height, he will be confronted on this silent, narrow forest path by some great mass of masonry that is the first glimpse of the fortress, the greatest part of which lies cunningly hid amidst the rock, and which now is so overshadowed by the pines that no glimpse of it can be obtained until one stands amidst its walls.

But frequently the first sign that the summit of the mountain is being neared, ere yet the light can be seen breaking above through the on-stretching aisles of pines, are the columns of basalt that pierce the sandstone and screes, and tell of what the core of the mountain is built.

The whole district is volcanic, and basalt and porphyry and granite combine with the sandstone to form the strange and fantastic shapes that the mountains and rocks have assumed. The heights of the mountains vary from one to three thousand feet; but for those who long for higher altitudes, in the near distance are the Giant Mountains, with heights ranging from five thousand to six thousand feet, and where the white glitter of snow is rarely absent.

The castles that crown the caps of these masses of porphyry, or columns of basalt, form the greatest charm of this district. Each one (and they may be reckoned by the dozen) has its own peculiar character. Its development is marked through the ages of Fist-right and of Priest-right, or of Kaiser-right; and cunningly devised means of defence, or devilish suggestions of horrid torture, or traces of past regal splendor, or of churchly munificence or cruelty, all now unveil themselves to the eye of the curious traveller until he halts and lingers, and dreams over these yet well-preserved proofs of how terrible a history Bohemia has endured and survived. Three typical castles within this mountain circle are the ruined fortresses of Burgstein, Bösig and Oybin, each entirely different from the other in situation and in formation. The first lies in a flat plain, the second caps imperially an open height, the third is also upon a mountain height, but is hid amidst the natural towers and bastions of sandstone that also form a part of its walls.

Burgstein is perhaps unique in Europe, for no masonry is used in its structure. Simply an isolated mass of sandstone lying in a flat meadow, some short distance from the mountains, has been scooped out and formed into a powerful fortress, with halls and armories, banqueting and dwelling rooms, and stables, chapels and dungeons, and, as in all these Bohemian castles, the inevitable horror of a hunger tower. The soft sandstone of the inner walls of this tower now open to the light of day, are scored with the marks of the wretched prisoners who had been hurled or let down into its depths to die slowly of hunger and broken limbs or wounds.

If Burgstein has no architecture, and was but merely a robber knight's stronghold, with a short but stirring history, Bösig can boast of imposing architecture. Robber, knight, and emperor and Church, have all added to the glories of Bösig; and the mighty towers and embattlements that yet rear themselves up proudly on the mass of porphyry that forms its foundation seem yet to breathe of its past splendor and glories; whilst the beautiful little chapel that overlooks the eastern precipice of the mountain speaks of the struggles for priestly supremacy that tore and ravaged this district until human flesh was not safe from the teeth of starving, dying, maddened men.

The third castle mentioned, the Oybin, is totally different from the others both in architecture and situation. It has a strange charm and beauty of its own, and the forest pines that cling around, and hide and overshadow its walls give a solemn calm to its cloisters and chapel and tiny precipice-clinging God's-acre. And they add now to the secrecy of the castle, for they hide entirely the earliest embankments and masonry that surround the extreme summit of the mountain, and overtop the later and greater castle and chapel.

In a short *résumé* of the sights and scenes of this district there is not space to describe fully either the castles or their history; but the latter is generally far more romantic, and sensational, and murderous, and horrible than the most blood-thirsty of "shilling-thriller" writers would dare to invent. And after living for a time in these mountain-tops, amidst dungeons, and halls, and cloisters, and the never-omitted hunger towers, it is like leaping onward some centuries to descend again into the meadow lands, and see the peasants working peacefully in the fields. They often work in long lines of twenty to thirty, perhaps one or two men, and the rest women; and as the women are dressed in every imaginable color, and each with a different colored head-dress, the effect against the brown arable or green pasture is singularly striking and "operatic." Frequently upon the roads the

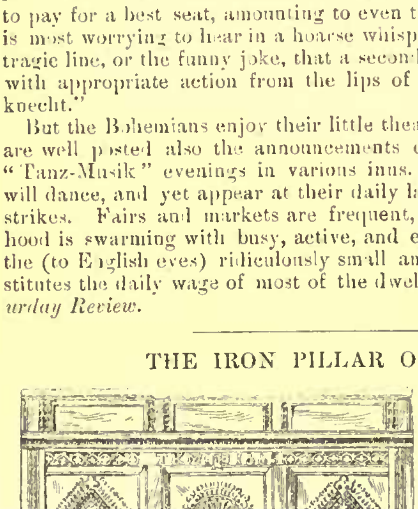
characters met with are almost alarming in their Bohemian wildness. They have great jack-boots and short jackets, long, black wavy hair, and high slouched hats, with a sort of leather sabretache slung across the shoulders, the leather being nearly hid with little brass plaques that appear to be highly useless but ornamental. These characters are generally extremely dirty, and speak only Cech, whilst another peculiar and rather wild-looking person frequently met is the Moravian pedlar, who wears a white felt hat with black embroidery, a long white coat also laced and embroidered, short baggy breeches, formerly white, with scroll designs worked down the side, and like the Cech, great jack-boots. These men are often large buyers of the Bohemian glass and pottery, which they take down the Danube and sell in the remote districts of Hungary and Transylvania, and although their dress gives them a strangely romantic appearance, yet both Cech and Moravian give one "good day" in a pleasant and civil manner.

The services in the churches are often a rich treat both for eye and ear. The women who crowd the church with their brilliant head-dresses, now of silk instead of cotton or woollen, give vivid color to the scene, and the organ, assisted by a good string band, and frequently an excellent choir, interprets well the music of the mass. At their funerals also they always have a band that plays a wailing, weird air in front of perhaps (even for an ordinary funeral) some hundreds of people; for all who have the spare time join in the procession, which is often very curious in its composition. On each side of the coffin women bear lighted torches, and as the long procession winds up some hill, the strange effects of color in the crowd, and the plaintive notes of the slow march arising from it have a most striking effect.

But their fondness for funerals does not prevent them going heartily into what is generally accepted as *la vie de Bohême*, dancing and music and theatre. Every little village has its theatre; perhaps simply the large room in the principal inn, where strolling companies play very frequently; and veritably they are indeed "poor players," for perhaps the star on a benefit night, even in a fair-sized town, will gain but two or three gulden for his share of the spoil. And after the play is over, and "Baron" and "Count" descend from the little boards that rattle and shake with every step of the actor, and even tremble beneath the lighter pressure of the foot of "Baroness" or "Mädel," the scenes in *Wilhelm Meister* are before one, and "Phyline," and "Melina," "Laertes," and the Herr Director may all be seen seated amid the crowd of beer and coffee drinkers, who are discussing vigorously the qualities of the plays and players. The "prompter" has no slight part in these Bohemian theatres, for he repeats in a very audible husky tone every word of the play, just a line or two in advance of the actor; and if one has been rash enough to pay for a best seat, amounting to even the sum of seven pence, it is most worrying to hear in a hoarse whisper from the prompter the tragic line, or the funny joke, that a second or two afterwards issues with appropriate action from the lips of the "Baron" or "Hausknecht."

But the Bohemians enjoy their little theatres, and in every village are well posted also the announcements of probably two or three "Tanz-Musik" evenings in various inns. Far into morning they will dance, and yet appear at their daily labor when the hour of six strikes. Fairs and markets are frequent, and the whole neighborhood is swarming with busy, active, and even jovial life, in spite of the (to English eyes) ridiculously small amount of money that constitutes the daily wage of most of the dwellers in this district.—*Saturday Review.*

THE IRON PILLAR OF DELHI.



DURING my sojourn in Delhi I visited and inspected carefully the Loha-ki-Lat, or the Iron Pillar, as it is known universally to the natives and English residents of India respectively.

This celebrated object is situated in the midst of the Masjid Jama, Masjid-Kuv-vat-ul-islam, an ancient (Muhammadan) mosque, now in ruin, which is believed by archæologists to occupy the site of a still more ancient (Hindu) temple of Rai Pithora, or Prithiraj, (the son of Someswara, and grand-son of Visala Deo, the Chohan conqueror of Delhi,) who reigned during the last decades of the twelfth century. Accordingly, it is in the midst of the Qil'ah Rai Pithora, or the citadel built by this monarch, the last of the Hindus to rule in Northern India, in the midst of several of the thirteen capital cities which in succession have appeared and disappeared in the course of time within the forty-five square miles of comparative waste around the modern city of Delhi, and which collectively compose the Rome of Asia; and it constitutes thereby one of the historic hubs about which the associations of mankind have revolved for ages in the past and will revolve for ages yet to come. It is a monument of antiquity involving humanity that has few rivals; one of which, I may remark incidentally, is within a cable-length or so of it, the Qutb Minar, a tapering, balconied and elaborately inscribed and ornamented shaft of fine red sandstone and marble, two hundred and thirty-four feet in height, generally regarded as the special glory of Delhi, as the Taj Mahal is of Agra.

As it appears to the eye, the Iron Pillar is a polished and inscribed, cylindrical and tapering shaft of metal, surmounted with a capital which consists of a series of bevelled rims one above the other; and, as it has been found to be by measurement, it has a total height of twenty-three feet, eight inches, about twenty-two feet, six inches of which are above the ground and fourteen inches below, and a diameter below of 16.4 inches, and above of 12.05 inches. The capital is about three and one-half feet long, and the base, imbedded in the platform from which the monument rises, is said to be "an irregular knob in shape, resting on several little bits of bar-iron, let into the stone underneath, and secured with lead." It is of undoubted antiquity — from one to two thousand years old. From which statement it may be inferred that the archæologists who have made it a special study have not determined its age with unanimity. Indeed, the archæologists, chemists, linguists and other men of science differ so much in their determinations with respect to this celebrated pillar that, doubtless, it will be regarded soon as a stupendous apple or bone of contention, constructed and set up by a misanthropic monarch of old in mockery of the assumptions of science in his own and succeeding ages!

The date of the building of either the mosque or temple has nothing to do with the date of the construction of the pillar. Moreover, the size of the pillar is not such as to make its removal from one place to another an impossibility, or even a task involving any extraordinary difficulty. It is found to-day as indicated above; but when or where it was made are matters beyond the significance of its surroundings.

With respect to its material, which is a matter of great importance in determining the value of the monument as a mile-stone in the march of man, the majority of the travellers and others who have written about it describe it as "mixed metal," "bronze," and "composition." Jacquemont calls it "soft iron." Dr. Murray Thompson, after analyzing it, says it is "pure malleable iron, of 7.65 specific gravity." Carr Stephen asserts that it is "wrought iron;" and Dr. Bhau Daji persists in his statement that "iron forms no portion of the monument whatsoever, and that it is a compound of several metals." In learning which, gentle reader, you, doubtless, will come to the conclusion of my worthy friend, Mr. William R. Jones, the General Superintendent of the Edgar Thomson Steel Works, that chemistry was invented by Ananias, for, otherwise, the contradictory statements and analyses of chemists are unaccountable. After which I may venture an opinion of my own — not being a chemist.

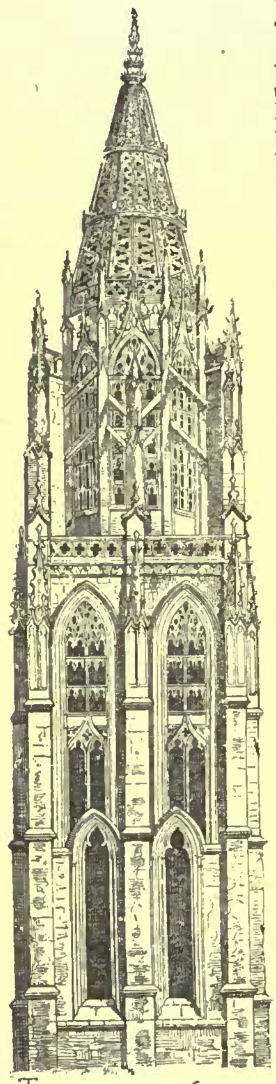
When iron in any known form (unless protected by the new process of Professor Barff, of London) is exposed to the atmosphere it becomes oxidized or rusts. Now the pillar in question, albeit exposed to the atmosphere for a thousand years or more, is not only not rusted, but the lines of the inscriptions with which it is covered are as sharp and distinct as if engraven but a month or so since. Argal (to use the corruption of the grave-digger in Hamlet for ergo), the Iron Pillar of Delhi is not iron at all!

But what is it? When doctors differ, as is their wont, I decide for myself, as is my wont, leaving others to do the same, from the best information at hand. The material of the monument is a kind of bronze, and the monument as such is remarkable only for its massive size as a relic of the Bronze Age of Man, and not, as commonly regarded, as a prophetic prodigy of the Age of Iron; and, moreover, from the evidences offered by its appearance on close inspection, I believe it to have been cast and shaped in a very simple manner, to wit, with the common blowpipe and such planes and chisels as the metallurgists of India possess to-day, as, doubtless, they have possessed for ages past. Bit by bit the bronze has been fused by the blow-pipe and welded together into balls or other more or less regular masses. These balls, then, have been laid in a trough and welded together in the same manner by the patient workmen, bit by bit and part by part, until the whole assumed the form of a rough, cylindrical and tapering mass, with a crude capital at one end. The rough shaft then was planed and polished, and inscribed and set up; its construction not involving a greater amount of metallurgical knowledge and skill than that possessed by the Indian workers in bronze of the present day. In proof of this having been the process by which the monument has been constructed, it presents in the mottled appearance of its polished surface, and in the lines and swirls and twists to be observed here and there, the same evidences which I have noted in a polished pump-handle made forty or fifty years ago by a rural blacksmith in Western Pennsylvania — every bit of old or waste iron of which the long and curved lever was composed by welding being apparent in it after it became smooth and bright in constant use.

And now, in conclusion, a word with respect to the inscriptions on this celebrated monument of antiquity. As the chemists are not agreed as to its composition, so the linguists, with respect to the writings which at various times have been engraved upon it. Some,

time ago Mr. Prinsep translated the oldest of these inscriptions into English, and the world wondered; recently Dr. Bhau Daji translated the same into English too, and the world blundered — that is, the differences between these two learned men are so great as to indicate an error in one or the other egregious enough to have the effect of a universal blunder. — *Frank Cowan in The Bulletin.*

CORNICE AND DEMOLITION ACCIDENTS.



TOWER OF THE CHURCH AT CAUDEBEC. FRANCE.

THE "arch," according to an Eastern proverb, "never sleeps"; it is always exercising an active wedge-like influence, and, therefore, silently doing its work of destruction. In many a ruin of a Gothic monastery the fragments of arches and the solitary arch still spanning the deserted nave, as we see in the tower arches of Tintern and Fountains Abbeys, appear to contradict this assertion, but they do so simply by virtue of the power of cohesion of the cement which binds the stones together. What is thus true of the arch is to some extent true also of the cornice. It never sleeps, but is always actively engaged in obedience to the law of gravitation and by its own weight, in exerting a lever-like power to overthrow all that is above it. These two active agents of destruction have ever been a source of trouble to the architects of all ages. In Italy many a beautiful structure is spoiled by the iron ties and bands which are introduced to counteract the first, and the bolts and other means taken to prevent the tilting of large and weighty cornices. In India and other Eastern countries subject to the shock of earthquakes, both these features have a bad reputation; and they have, therefore, been generally discarded, or introduced only under certain safeguards. Even in this country, under strict building-rules and the vigilance of surveyors, they now and then give trouble. Not many weeks ago a massive stone cornice, forty-eight feet in length, on the west side of Cannon Street Congregational Chapel, Preston, fell, one morning, and utterly destroyed a portico of the school in the basement area, but fortunately injured no one. A similar accident, though happily unattended with fatal consequences, occurred August 5 in the Savoy. The work at the new Medical Examination Hall of the Royal College of Physicians and Surgeons, which is favorably progressing, had arrived at the cornice level, and the workmen had placed the stones of the cornice *in situ* along the western side, and had strutted them at intervals before proceeding to lay the blocking-course over, when the whole cornice gave way without the slightest warning. The scaffolding, which was erected against the same side of the building, gave way under the blow like matchwood, and presented the appearance of a twisted bundle of broken sticks. Luckily none of the men were injured; they possibly, if accounts be true, had time to get within the building through the window openings. The stonework was of massive character, and must have weighed many tons. It was plainly moulded, and, from the section we have seen, the "over sailing" was small, not exceeding in projection from face more than two feet, with a good bed-mould beneath the cornice. Provision has been made in the details and specification for connecting the stones by cramps; they run through the whole thickness of wall, and every precaution was provided so as to prevent accident. The design of the architect shows a parapet nine feet in height above the cornice, and measuring in thickness eighteen inches for several courses, and then fourteen inches to the coping — a mass of brickwork capable of holding down a cornice of two or three times the projection, to say nothing of the iron roof, which is intended to rest upon it. But, as in all accidents of this kind, it was before this counterpoise had been built, and during the process of placing and temporarily supporting the cornice, that the fall took place. Struts at intervals were provided, abutting against a stone string-course some feet lower down. We allude to the circumstance here simply to draw the attention of builders and masons to the great need at this stage of building of providing against casualties of this nature. The ordinary course is to strut up the stones from the wall below, as was done here, but we have even heard of the scaffolding being made to support the cornice at this juncture. A safer plan is to provide a temporary staging of planks and struts to take the projecting part of the corona of the cornice, taking care that the weight be thrown upon the walls. The Metropolitan Building Act is almost silent upon the point. Section 26 provides that every cornice is to be of some fire-proof material; but no very clear or distinct rule is given. Only in detached and semi-detached dwelling-houses, distant at least fifteen feet from any other building and from the ground of an adjoining owner, is the above rule relaxed, a condition which, of course, implies a building surrounded to that extent by its own ground. The Act allows a builder to corbel out a chimney stack above a certain height to the full thickness of the wall, and a similar rule might not be unsafe when applied to cornices, though the conditions of the two structures differ. In a corbelled chimney the bond increases in strength as the work is carried up in height, and it is only practically the lower courses that bear on the corbel, or stone, inserted at the commencement. In the cornice the weight of the projecting portion must be counteracted by sufficient weight behind, as there is no upper bond to assist. A corbelled stack does not overhang its whole weight like a cornice, and when the bond is good and the mortar is good it has no overturning power for mischief when the walls are well tied in. The chief dangers in the cornice are during its construction in crowded streets, in the want of sufficient counterweight or parapet when finished, and imperfect dowelling of the stones. For a heavy and very projecting cornice a wrought-iron band placed along the upper courses of cornice, tied down at intervals by iron ties to the brickwork or to the beams of a floor, is the proper means of securing its safety. Many fatal accidents have taken place through the fall of cornices in streets. Only a few years ago a heavy cornice in Fenchurch Street fell, and killed a gentleman; and we well remember a fatal accident in Wood Street, and another in Great Winchester Street, both from falling cornices. Another danger is owing to the improper construction of cornices, and the falling of portions of the stone from the effects of frost. Some years ago a man was accidentally killed at Ipswich from the fall of a stone from the cornice of the town-hall, weighing ¼ cwt. Frost had acted upon a piece of the stone and had loosened its hold upon the adjacent stones. By a proper system of cramping the stones at the back, or by dowels of copper, slate, or galvanized-iron, such an untoward accident as the falling of fragments might be prevented. The dowels should be introduced between the stones which overhang. There is great care to be exercised, however, to prevent the metal becoming a source of weakness to the stone. Cramps, if not properly run with lead or cement, may create the very mischief sought to be avoided, by leaving crevices for the water to lodge and congeal, and certainly dowelling is the safer mode.

The other day some excitement was caused by the fall of a house at the corner of High Street, Bloomsbury, and Oxford Street, facing the Horseshoe Hotel. The fall was due to the partial demolition of the houses at this spot, under the Street Improvement scheme. Three men, at least, amongst those who were buried in the ruins, sustained serious injuries. Unexpected falls of this kind are almost impossible to be averted. But are they always to be classed under the category of accidental? Often carelessness, or a fool-hardiness on the part of the men engaged, is the immediate cause. Stricter care seems, moreover, necessary during the stage of demolition than appears to be generally bestowed by the authorities. Many of the old houses "hang together" rather than are upheld by their own foundations, and when one is removed, which has acted as a sort of wedge, the adjacent houses yield and collapse. Corner houses are generally very "risky" buildings, and their shorings ought to be undertaken before any demolition is commenced. Any one would imagine it would be safer to commence at the corner, and proceed slowly with the adjoining houses; but, of course, every case must be law to itself. One rule which must always be a safe one to follow in demolition, as in building, ought to be observed, though we see every day instances where it is not followed. We mean the simultaneous pulling down of a whole row of houses. The difficulty, no doubt, is to get a sufficient number of hands to undertake the work at once, in cases where a whole line of one side of a street has to be demolished for improvements. Often the leases fall in by degrees, and only one or two properties are acquired at a time; but under the larger scope of the Metropolitan Street Improvement Acts it becomes possible to take in hand a large area at once, and when that is possible an immense amount of shoring and risk may be saved by a gradual taking down or removal of the whole of the buildings simultaneously. Nearly all the accidents we hear of are owing to the partial demolition and want of shoring. — *Building News.*

NOTES AND CLIPPINGS

Cremations at Pere La Chaise. — Next month the Parisians will be able to burn their dead in four crematory furnaces, which have just been finished at Père La Chaise. These furnaces were begun last November, and have been hurried on to completion, so that by the end of August at latest those who, in dying, express the wish to be cremated, can be there reduced to ashes. There will be no first, second, or third class cremations. Poor and rich will be on a footing of absolute equality. The price charged to those who can afford to pay for the burning of a corpse will be 15f. — or, say, 12s. The furnaces were constructed on plans by MM. Barrett and Formicç. A large portico is in front of a dome, beneath which are placed the crematory furnaces. They have the appearance of very elegant ovens. Three hundred and fifty thous.

and francs was the price they cost. They are, according to the Corini system, in use in Rome and Milan. It was found that the heat of the Siemens furnace was too intense. Instead of reducing the corpse to ashes, it subjected it to a kind of vitrification. The cost, too, would be 200f., instead of 15f., to cremate with a Siemens furnace. The unclaimed bodies at the hospitals which are not used for anatomical purposes will be taken to the crematory at Père La Chaise. Sculptors, goldsmiths, and bronze casters are already busy designing urns, of which an assortment in marble, bronze, gold, silver, zinc, or lead will be kept at an office of the crematory. The relatives of the cremated dead can buy these vessels, and cause them to be removed to family vaults, or to a building which the City of Paris is to erect. There could be no greater boon to a large city with overcrowded cemeteries than the furnaces of Père La Chaise. I cannot conceive anything more disrespectful to the dead than the way their remains are treated here, even when a first-class burial can be provided, if there is not a family vault in which to place them. Buying a grave is no simple matter. The delays are endless, and the application for one must go through many bureaus before official consent is given. Then there are other formalities to be gone through. Meanwhile the corpse is in a charnel house, called a provisional vault, at a cost of one franc a day. The removal thence to the grave, which must be in masonry at the sides, is a cause of danger to the public health.—*London Daily News.*

A Carved Wine Cask.— There was finished and exhibited in Mayence recently a richly-carved wine cask, capable of containing upwards of six hundred litres, entirely made from the wood of the old Roman bridge, built under the Roman emperors Trajan and Maximian, and discovered and taken from the Rhine in 1880. Of the wood still remaining, more casks of rather smaller dimensions are to be sent to the United States.—*Exchange.*

The Internal Temperature of the Earth.— The London *Times*, referring to the deep shaft being sunk near Schladebach by the German Government, with the special object of obtaining reliable data concerning the rate of the earth's increased temperature toward the interior, concludes, from all that has thus far been developed, that the earth's crust cannot be more than about one-ninetieth of its radius. It seems that the plan pursued has been to ascertain the temperature at successive stages by means of a special thermometer, the principle of construction being that, as the heat increases, the mercury will expand so as to flow over the lip of an open tube, the difference of the overflowing giving the rate of increase of the temperature. At the depth of 1,392 metres the temperature indicated 49° centigrade, or 120 Fahrenheit. If the temperature increases regularly at this rate, the boiling point of water ought to be reached at a depth of 3,000 metres, or nearly two miles, and at forty-five miles the heat would be that at which platinum melts.

The Castle of Chillon.— "There are ruins so precious that it becomes us to arrest their decrepitude, and by dint of pious restoration to constrain them to live." Thus wrote Rousseau about the castle of Chillon, that cherished possession of the Canton de Vaud. The ancient fortress, built upon a rocky ledge which juts out into the lake of Geneva, is as well known to travelled Englishmen as Tintern Abbey or Haddon Hall to their stay-at-home compatriots, and has a story as romantic as that attaching to "the castled crag of Drachenfels" or to any other historical ruin upon the Rhine. Says the London *Telegraph:* Nearly seven centuries after the foundations of the first castle erected upon that spot were laid in the rock which carried and supported the structure, two great writers—one of them English and the other French —connected Chillon in the first case with a poem and in the second with a romance, which will neither of them die. "*The Prisoner of Chillon*" is at least as popular and as widely known as any of Lord Byron's shorter poems, while Rousseau's "*Nouvelle Héloïse*" was held by George Eliot to be unsurpassable for beauty. Lord Bryon tells his friend and correspondent, Thomas Moore, that when he wrote "*The Prisoner of Chillon*" he knew next to nothing about Bonnivard, the hero of his tale. "When this poem was composed," writes Lord Byron, "I was not sufficiently acquainted with the history of François de Bonnivard, or I should have endeavored to dignify the subject by an attempt to celebrate his virtues and courage." It is, perhaps, more to the purpose, as an evidence of the aimlessness and waywardness of Byron's erratic genius, to know that "*The Prisoner of Chillon*"—which was composed in a day and a night at a little inn or cabaret at the village of Ouchy, the lake port of Lausanne—would never have been written had not its noble author been detained there in the June of 1816 by stormy weather. Such was the facility with which Byron wrote, and so fertile the harvest produced spontaneously and at will by his ready brain, that the hundredth anniversary of his birth, which will come round upon the 22d of January, 1888, can hardly fail to be celebrated with becoming honor by Londoners, who recognize Milton and Byron, as well as Spenser and Chaucer, as the greatest poets born in this metropolis. There are some critics among us—and that Mr. Algernon Swinburne should be one of them is a cause for widespread regret—who pretend that Byron's rank among poets is not as yet fixed. Mr. Matthew Arnold, again, is of opinion that his great favorite, Wordsworth, "has left a body of poetical work superior in power, in interest, and in the qualities which give enduring freshness, to that which any other English poet has bequeathed to his fellow-countrymen, Shakespeare and Milton alone excepted." Now, Wordsworth composed verses during a space of sixty years, while Byron's entire literary career does not extend beyond fifteen. Yet we hazard little in saying that for every Englishman—and still more for every American, by which nation the ultimate rank and value of English poets will finally be appraised—acquainted with "*The Excursion*," there are at least one hundred to whom "*Childe Harold*" and "*The Prisoner of Chillon*" are precious possessions. It is said that the Canton de Vaud is about to repair the castle of Chillon, and to make it a residence fit for human habitation. We see no reason why one of the most interesting buildings in the world should not be rescued from damp and decay, so that it may afford shelter to happier human beings than the luckless prisoners who once pined within its gloomy dungeon walls. The lake which laves and gently kisses its foundations is said to be eight hundred feet deep beneath the windows which still dimly light Bonnivard's cell, and in the seven pillars which Byron has immortalized the iron rings to which the early reformers were chained are deeply embedded. The furrow wrought in the stone pavement by Bonnivard's footsteps during his six years of incarceration is still visible, and across his cell stretches a wooden beam black with age, from which, it is said, that the condemned were formerly suspended. We entertain no doubt that the dungeon occupied for many generations by nameless prisoners, and celebrated by Rousseau and Lord Byron, has long brought in a good revenue to the syndic of the canton in which it is situated. To be on the lake of Geneva without visiting Chillon would be tantamount to putting "Hamlet" on the stage without assigning a part to the Prince of Denmark. Even, however, if Chillon be repaired and modernized, the flow of English and American visitors will probably know no decline.

TRADE SURVEYS

If the railroad-building, manufacturing, and house and shop building interests have the wit to continue for a few months to come in the sensible policy circumstances have rendered it advisable for them to pursue for a year or two past, the favorable indications on all sides will become realities. If our political and social economy were sound, depressions would be less frequent than they are. The guarded expansion in all directions is simply wise economy. The increased compensation to labor is simply a step towards natural conditions. Increased production, if precipitated now, would find the country not quite ready for it. Values have found their lowest legitimate level; any further depression will come through bankrupt conditions, which are far from probable. It is well that builders, promoters and investors are as prudent as they are proving themselves to be. The consumptive appetite of the nation will not stand much over-loading; to over-load or over-crowd now would be to frighten back the spurt of extensive and liberal investments now apparent. That spurt must be permitted to work; to be, in fact, encouraged by higher prices and wider margins for a while. The investments of the past two years must be permitted to take deep root; all this could be done with care; speculation will in this way be kept in check. The developments day by day point to no great change in the current. Heavy imports of gold are counted on, running into a score or two million dollars, to balance the international trade-scales. Financiers have been asked as to the wisdom of large investments on European account, not in speculative railway securities, but in more legitimate channels. Many of the evils society is supposed to be suffering from will be largely removed through the growing abundance of anxious capital. As has been often observed, competition heretofore has generally been between opportunities, each opportunity begging capital to come and make the most of it. Hereafter, competition will be within capital itself, each possessor seeking the best opportunity to increase his possessions. This is the characteristic of the present transitional era in industry and trade. A second is, the great near-at-hand outflow of the over-crowded masses into newer fields. Evils of government, and economic evils, will be largely corrected by dispersion, and the liberated energies will dash out into new directions. To-day the reports from the world's great centres show that an emigrating era is near. Business develops slowly. Last week's volume shows no marked increase. People do not know fully what to make of the strengthening tendency in prices. If they believed it would be legitimate, September would witness such a rush of orders and contracts as we have not seen for years. It is better the public should doubt and hesitate. Our safety is in conservatism. To boom things is to invite disaster next season. The farmers want first to market their grain, and the planters their cotton. The industries will take their cue from this. Three years ago we produced goods six months before we were sure we would need them and could pay for them. To-day the purchaser is in sight before the wheels begin to turn. Hence, demand is legitimate. Stocks are light; prices are firm, and confidence is universal.

The builders are almost everywhere busy and architects allow us to say that considerable additional fall and early winter work is on hand. Real estate in Western towns and cities has been changing hands freely all season and will hold the advance it has made until another season. Building activity is continuous in the Middle States, especially in Pennsylvania. Trust-companies and large money-lending corporations authorize the statement that mortgages are being wiped out faster than new obligations are created in the New England and Middle States. This does not apply so forcibly to the Western and Southern States, where money is in urgent demand for industrial and commercial purposes. Builders are pleased at the success met with in selling and renting houses, especially in smaller cities where the manufacturing spirit is penetrating. Building material continues low. Lumber shows some firmness in Western markets, but continues rather weak in Eastern, where buyers have opportunities offered to stock up at early season prices. Receipts are heavy in yellow and white pine and in all the hardwoods used by house-builders and furniture-manufacturers. The iron and steel makers report further activity and greater strength especially in bar-iron. Nails are strong at $2.10 in tide-water markets and merchant steel is moving freely at fair quotations. A great deal of money is being spent by municipalities big and little, by railroad managers, shop and mill owners and by manufacurers generally in extensions and improvements. The textile manufacturers are content with moderate returns in dividends and are liberal in the purchase of machinery and supplies. The coal producers talk discouragingly about the markets but it should be remembered the anthracite production is 1,500,000 tons ahead of its limit at this date last year and the soft and block coal miners are also ahead. In other industries good reports are submitted. For instance, in the item of school, church, bank and office furniture the sales according to several good sources of information are ten to fifteen per cent in excess of last year, even in the face of failures at one or two points. The commercial failures show a healthy falling off. Few grave labor complications have arisen. Employers are gradually getting together for better mutual understandings, the effect of which will be to minimize competition and to establish fixed value for labor and its products. Arbitration is growing in favor as a temporary make-shift and coöperative enterprises for productive purposes are springing up every week on a small scale. The Minneapolis coopers have accomplished good results. Cigar-makers, carpenters, broom-makers, coal-miners and rug-makers have within a short time made a good start, but the memory of past failures remain to warn the promoters of these enterprises of the dangerous work they have entered upon.



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CONTENTS

ON the night of Fourth of July last, a large fire broke out in one of the upper wards of New York, and the chief in command of the district "rang-in" three alarms in quick succession, which brought to his aid so large a proportion of the engines in the city that the fire was easily extinguished. Unfortunately for him, his action left the greater part of the rest of the city improperly protected on a night when fires were peculiarly likely to occur. For this "error of judgment," as his superiors were pleased to call it, but really for political reasons he was brought to trial, and most unjustly dismissed the service. This incident has emphasized the fact that under similar or not very greatly different circumstances the city might again find itself practically at the mercy of incendiaries or accident. The city is able to provide engines and men enough to meet any exigency, but it finds a difficulty in providing engine-houses in those places where it is most desirable to have them, and there seems no immediate likelihood that suitable sites for new engine-houses can be secured; and though there is now in operation a system by which a certain number of extra engines are kept in reserve, stored wherever shelter can be had for them, and which under certain circumstances (when the regular engines are called away or moved-up to the next station) are brought out from retirement, and stationed in the regular engine-houses ready to respond to the next alarm, it is not entirely satisfactory. The Fire Commissioners under these circumstances are considering the possibility of doubling the effective force of the department without increasing the ground-rent paid by the city. It is proposed to re-arrange all the engine-houses so that the basement may contain a second engine, which, standing on a movable platform, could be raised to the first-floor level, as soon as the first engine had been called out. The suggestion is a sensible one, and perfectly practicable: indeed, there is no reason why a third engine should not be stationed in the second story, and there is no reason why the second and third engine should not respond as rapidly as they can to any call coming from their special district, as in this way the force stationed at a single engine-house could take care of most of the fires occurring in its district, and thus prevent delays and the dangers to people in the street which are caused by engines from adjoining districts hastening to the fire. The men and horses for the new engines could be housed in the upper stories, since it is possible to extend the buildings upwards as far as may be necessary, and it is no new thing to keep horses up stairs. If any such system is adopted, it seems to us that one of the engines in each house should be a chemical engine, and that, for obvious reasons, it should be the one to occupy the ground-floor, and be the first to respond to the alarm. Chemical engines have proved themselves much more useful auxiliaries than seemed probable at the time of their first introduction, and certainly have already prevented a vast loss from injury by water.

FOR more than twenty years Boston found Charles C. Perkins a most useful citizen to have within its limits, and his fellow-citizens who knew nothing of him personally were accustomed to seeing his name figure in the lists of committees having in charge any educational movement that had a bearing on the development of art in that city; and they must feel as do those who really knew him, that the carriage accident which last week deprived him of life created a vacancy in the ranks of those who are public-spirited, as well as instructed, that it will be hard to fill. As Mr. Perkins was a man in easy circumstances, he was able to follow his inclination and devote himself to the critical study of art, and his unselfish nature was so well understood that others who might have shared in much of his semi-public work stood one side, with the knowledge that he could and would interest himself in these matters, and that they would be conducted uprightly and intelligently. How soon after graduating at Harvard College, in 1843, he began to devote himself to art we do not know, but he gave some attention to studio work, and acquired considerable skill with water-colors, though his predilection for the use of *gouache* and the labored manipulation of his colors gave most of his work rather the air of oil-painting than of water-color sketches. But it was mainly as critic, writer and lecturer on art that he earned his reputation, rather than by any art-work performed by his hands. In these literary channels he was a busy worker, and besides being a frequent contributor to journals and magazines, he accomplished a more enduring work in the publication of three works, "*Tuscan Sculptors*," "*Italian Sculptors*," and "*Raphael and Michael Angelo*," which are held in good repute both at home and abroad. As literary adviser to both friends and strangers, he often gave welcome assistance, and for a year or two did the same service for the *American Journal of Archæology*, of which he was consulting editor. His private work in a manner concerns mainly his friends and his family, but his public service concerns all of his fellow-citizens. To him was largely due the erection of the Boston Music Hall, and the performances there by the Handel and Haydn Society, of which he was for many years president, of the oratorios, and the other choral music, which made Boston for so many years the musical centre of the country. He was one of the leaders in the movement to establish the Museum of Fine Arts, and was always a member of its board of trustees, and he was peculiarly active in bringing about the introduction of instruction in drawing into the public schools. There are many men who take as much interest in art as he did, many who know as much or more about it; but there are few who know how to make so good use of their knowledge, or of whom, when their turn comes to have their life-work reviewed by the public, it can be said that the community at large sustains a real loss and will not easily find so willing a servant.

EVER since the beginning of the great modern movement which seeks to surround mankind with better sanitary conditions, architects have been forced to acquire an extra-professional interest in everything that relates to the disposal of sewage, and thus have been brought into closer relations with civil engineers, to whom all that concerns the construction and installation of sewers formerly related. As a rule it is in the ranks of the civil engineers that the first instructors of the public and the architects have been found, and the names of some of the pioneers are as familiar to us as to their own fellow professionals. Some of these men have devoted themselves as much or perhaps more to the sanitary condition of the house than to that of the town, while others have fixed their attention mainly on the larger work of municipal water-supply and drainage, and so are not so well known to architects. But the name of Mr. E. S. Chesbrough, who died last week at Chicago, is probably known to many, as that of a man who had gained high rank in his profession, and who in recent years had been called in as consulting engineer by cities in all parts of the country when there was question of introducing a water or sewerage system. We believe we are right in saying that Mr. Chesbrough did not have the suggestive and inventive faculties of some of his contemporaries, and in a certain way adhered to old-fashioned theories, but his work was always thoroughly prepared and carefully executed, and those who employed him might feel that though their works might not embody the latest

"fad" in sanitary engineering, it was nevertheless adequate to the demand to be satisfied. Mr. Chesbrough was born in Baltimore in 1813, and had a thorough training for his profession. Until 1855, he remained in the Eastern States, and amongst other things had a good deal to do with the Boston water-supply both as engineer to the Water Board, and afterwards as city engineer. In 1855, he took charge of the construction of the sewerage system of Chicago, and made that city his home. Perhaps his most notable achievement was the building of the tunnels through which the water-supply for the city is drawn from Lake Michigan, at a point which was supposed to be distant enough from the city to prevent all possibility of future contamination—it may be remarked here that this expectation has not been realized, and just now Chicago is much concerned to discover how it may obtain a purer water than the present works furnish. One of the latest of Mr. Chesbrough's tasks was the planning of the new sewerage system of Newport, R. I.

WE have not enough familiarity with the region about Niagara Falls to know how far the steps that have been taken to make an international park, which began, we believe, with suppressing certain mills and factories along the river, will actually interfere with all attempts to utilize the vast water power of the river and fall. Probably the most rabid worshipper of uncontaminated Nature would not object to the water's doing useful work for the world, if it can do it in so seemly a way as not to affect his delicate sensibilities, and so probably no injunction will be brought against the work which the Niagara River Hydraulic Tunnel and Sewer Company has incorporated itself to do. The work it is preparing to undertake is a peculiarly interesting and daring piece of engineering, but it seems a possible and reasonable enterprise, in spite of its very extravagance of conception. As we understand it, the Company undertakes to construct an enormous mill-race, in the form of a tunnel bored through the solid rock and superincumbent earth, from a point at the level of the river below the Fall up to a point about a mile above it, and it is said that at this point the head of water will measure about one hundred and twenty feet. From this point the tunnel is to continue up the river for about a mile-and-a-half, grading so as to be about one hundred feet below the surface, the path of the tunnel being about one hundred and fifty yards from the bank. The tunnel constructed, lateral feeders will be driven to the river, and gangs of turbine wheels set up, with all the shafting and gearing necessary for the operation of two hundred and thirty mills, each using five hundred horse-power, for this is the amount of power it is computed can be brought into service by the proposed work. What this amount of energy can accomplish may be appreciated if one can grasp the idea that the new mills will have at their command more power than the combined mills of Minneapolis, Holyoke, Lowell, Lewiston, Lawrence and Cohoes. Furthermore, it is estimated that the cost of the tunnel and its adjuncts will be about one-tenth the sum that has been spent for hydraulic engineering in the cities just mentioned. As we said the scheme seems mechanically practicable, owing to the great improvement made of late years in boring-tools, which can here be driven more economically than anywhere else, thanks to the limitless possibility which the Fall affords of operating them by compressed air. The delicate point of the undertaking would be the connection of the feeders with the river. But with coffer-dams on the outside, and the pressure of compressed air behind an air-lock within the work could probably be accomplished without mishap. The doubtful factors are the probable effect of erosion on the tunnel, and the possibility of getting at the machinery in the tunnel when there may be need of repairs.

IT is reported that work on the electric subways began in New York on Monday, and, so far as the physical fact means anything, the citizens of that city may congratulate each other on the appointment of Mr. Flower as a member of the Commission. But it is very far from clear that anything more than a beginning will be made. There are too many public and private interests at stake to allow it to be supposed that the work is to progress smoothly. Besides the unpleasant suspicions of rank jobbery which have been excited by the manner of awarding the contracts and the character of the men to whom they have been awarded, there is the vexed question of the constitutionality of the law under which the Commission acted, and the great probability that the law did not empower them to do more than examine and report. Then other companies have demanded their right to use conduits of their own, and some of these companies had a real existence before the company which has secured the contract was ever thought of. It is also said that Dorsett, who is to make the conduit tubes, can only do so at the risk of having to defend lawsuits which can, and probably will, be brought against him by those who hold patents for the governing principles which are incorporated in those which he undoubtedly does hold. It bids fair to become a very complicated business, which it is for the interest of all concerned, except the public, to prolong as much as possible.

IT is reported from Chicago that an architect has submitted to the Health Commissioner a scheme for erecting a tower — which has the elastic possibility of twenty-five or fifty stories — which, somewhat after the manner of the burning ghats of India, is to provide a means of disposing of the dead by a species of cremation. The tower, about which would wind an inclined plane, would contain innumerable cells or vaults which could be sold or leased to individuals or families, these vaults being arranged between the outer wall and a central flue or chimney-shaft; this is the most important feature of the plan, for it is proposed to dissipate the odors which would naturally emanate from a necropolis of this kind by keeping a "huge fire" constantly burning at the bottom of this central shaft, with the intention that the vapors should "smell to heaven" and not settle in deadly miasma on the city below. Thorough believers as we are in the desirability and necessity of disposing of the dead by cremation, we do believe that even the hasty Chicagoese will prefer more thorough measures, and will perceive that to submit their late friends to a species of slow cooking, as if they were potted pigeons, would probably have a most unpleasant effect on the appetites of their visitors at least. The ingenious architect declares that all that is required is an "act of incorporation and five hundred thousand dollars." It would seem that a little more money would also have to be provided if the "huge fire" is to burn perennially.

WHAT seems to be an excellent flushing-siphon is described in the *Revue Industrielle.* The siphon may be applied either to a small tank, for supplying plumbing appliances, or to sewers or sewage-tanks, and has the great merit of being of equal bore throughout, without weirs, edges or sharp turns to catch lint or sediment, while, as it could be made in five minutes out of a piece of lead pipe, the cost ought to be far more moderate than that of the devices usually sold for effecting the same purpose. In substance, the new apparatus, which is the invention of Herr Kuntz of Carlsbad, consists of a siphon, the longer leg of which, instead of continuing vertically downward to the end, turns, just before it reaches the level of the open end of the short leg, and runs obliquely upward for a short distance, then turning again and going straight downward to the outlet. This siphon is set in the flushing-tank in the usual manner, with the upper bend just below the top of the tank, and the lower end of the long leg opening through the bottom or end of the tank. The operation of the siphon seems to depend upon the weight of the water held in the little trap which is formed by the upward bend of the long leg. As the tank fills, the water rises in the siphon, compressing the air which is confined between the entering water and the water in the trap. The depth of the trap, which is about one-seventh the whole height of the siphon, seems to be so arranged that the water is not forced out of it by the compressed air until the tank is full, and as soon as the trapping water is pushed out, the water in the short leg of the siphon, released from the pressure which had kept it back, rises into the bend, filling it, and bringing the siphon into action. The flow continues until the tank is emptied as far as the open mouth of the short leg, when a bubble of air enters, the "siphon is broken," and no more water passes over; but that already in the long leg of the siphon falls back into the trap, filling it, ready for another operation. For the subsoil irrigation which is becoming so justly popular as the best way of disposing of the wastes from country houses, there is great need of an efficient and easily-cleaned flushing-apparatus, and in some respects this device appears better suited to the purpose than any other that we have seen described.

EARLY SETTLER MEMORIALS.—I.

"THE PILGRIM."



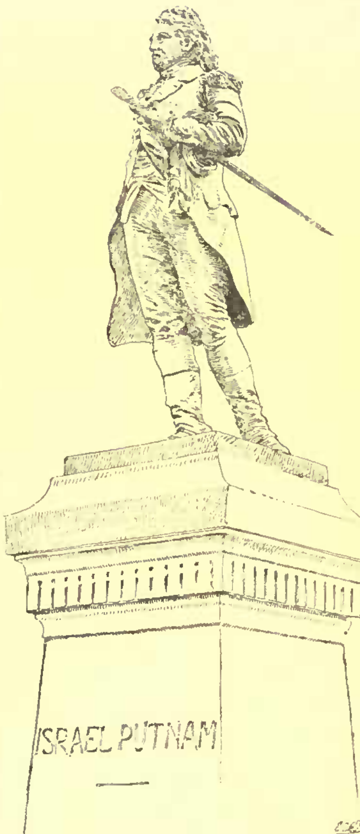
The Indian Hunter, Central Park, N. Y. J. Q. A. Ward, Sculptor.

THE imposing character of the event which the statue of "the Pilgrim," recently erected in Central Park, New York, is intended to commemorate, the influential and representative society that caused its erection, and the great American reputation of the sculptor who made it, all combine to give the statue an unusual interest. We learn from *Harper's Weekly* of June 6, 1885, from what may be considered an authoritative article which accompanies a large wood engraving of the statue, that the New England Society of the City of New York thought that "it would be a fitting and graceful thing to give some visible and tangible sign of itself, to do something which should be an agreeable and symbolic expression of the ideas which, as an association, it is designed to cherish and perpetuate. To this end it was decided to erect, in a suitable place, a piece of sculpture which should represent in an appropriate and artistic fashion some episode, principle or belief, historically or typically identified with the beginning of New England. The idea of a statue of one of the company of the *Mayflower* presented itself, and as it seemed to be a good one, and was adopted, thereupon the committee of the New England Society commissioned Mr. J. Q. A. Ward, N. A., to model a bronze statue of a Pilgrim: not of any particular Pilgrim, nor one of the historic figures of that time, but a presentation of a personality belonging to the period and the spirit of the people who moved in it." The article pronounces the statue to be "a large and honorable achievement, worthy of what it commemorates, and more than worthy of Mr. Ward's reputation and ambition as an artist. It is the best thing that he has done, the completest thing of all that he has executed, and it should be a very gratifying matter to the New England Society that its patriotic and creditable aspirations should have found such an admirable fruition," and adds that "the whole impression it conveys is the spirit of New England fashioning; of a man of convictions, of unbounded resolution, of unswerving loyalty to his own ideas, and surcharged with antiliturgy and fight." It is, however, noticeable that the article says nothing of how the statue represents "a personality belonging to the period and the spirit of the people who moved in it," what particular "episode" it illustrates, what "principle" it embodies or symbolizes, how it is connected with any "belief" indulged in by those who landed at Plymouth Rock, or in what way it represents "one of the company of the *Mayflower*."



Gen. D. Morgan, Spartanburgh, S. C. J. Q. A. Ward, Sculptor.

The statue is called "The Pilgrim," but its identity as such is left to the imagination of the observer. As to what the statue really represents, or is, there is, among the other New York journals, a difference of opinion. One affirms that it "represents a Puritan of the early part of the seventeenth century, dressed in the severe garb of his sect, standing erect and looking in the distance with a sweeping and searching glance, as if in half expectancy of his restless Indian foe." Another, that "it is the typical New Englander." A third, that it "is one of the old colony immigrants of 1620, and not one of the later Puritan settlers in the more northern colony of Massachusetts Bay." "Neither a man of the clerical type like Elder Brewster, nor a soldier like Miles Standish, but one who went armed with a gun to defend himself against the Indians, and usually with a Bible to protect himself against the Evil One." Two journals speak of the individual purpose of "the Pilgrim," or what he is doing. They say the attitude represents "one who is on sentry duty and has stopped in his short walk to look for the Indian foe."



General Putnam, Hartford, Conn. J. Q. A. Ward, Sculptor.

In all that has been said about this statue, including the oration by Mr. George William Curtis, delivered at the dedication, there is very little definiteness about the Pilgrims, and much mixing of Puritan and Pilgrim. We think we shall find in examining "the Pilgrim," that it is even more indefinite as a statue representing its name, than any attempted description.

As a work of art, it has not been received with that unanimity of commendation given to the sculptor's previous productions. Two other journals limited their reference to it to a detailed description of the costume, the weight and cost of the statue, and the pedestal that supports it. The *Herald* was inclined to be critical, and closes its observations by ranking it "among the half-dozen best public statues in the city." The "Easy Chair" of *Harper's Magazine* [for July] declares it to be "both a truthful and poetic rendering of the Puritan hero," . . . "that will unconsciously but truthfully refine and soften the familiar conception of the Plymouth Pilgrim and the great Puritan body to which he belonged," and that it is "one of the finest memorial statues in the country." The *Critic* is the only paper that has spoken in terms of positive disparagement of the statue. It calls it "a thorough betwixt-and-between," "not conspicuously bad, neither is it remarkably good." "From afar it calls the eye and delights the curiosity with queries as to what manner of manikin it may be." Comparing it with other statues by the same sculptor, it adds, "there is a grim and fatal dulness about them."

The facts on which all agree are that "the Pilgrim" is nine feet high, weighs some two thousand four hundred pounds, and cost some twenty thousand dollars. The size and weight of the four bas-reliefs on the pedestal are also given without any disagreement.



Ra-am-ke, an Egyptian wooden Statuette.

To the ordinary observer the questions of real interest seem to be, What does the statue represent? What has it to do with the Pilgrims? and What are its merits as a work of art?

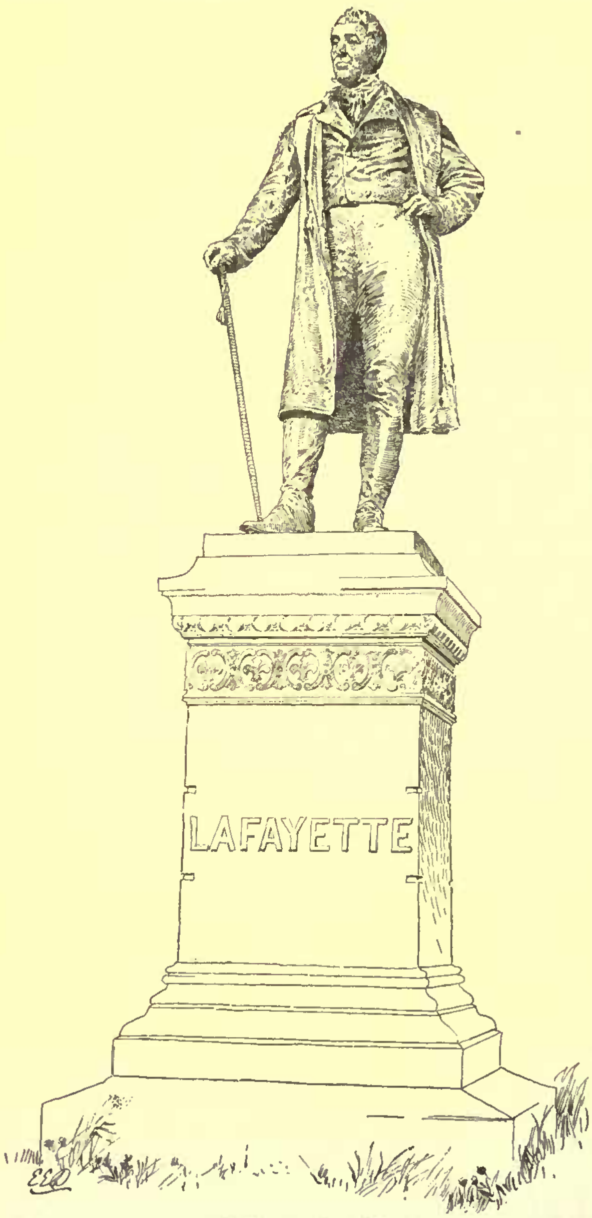
To us it resembles the figure of a man dressed in old English costume, with a gun, a weapon to which he is evidently a stranger (for no one familiar with it would ever place his hand over the muzzle, especially when it is supposed to be loaded) posing for his photograph. If the statue is intended to represent "one who is on sentry duty," it would be said that he was in a defenceless position and could be easily shot or even kicked before he could get his gun to his shoulder. Sentries have their moments of repose, but the requirements of sculpture, as well as the nature of their duties, do not warrant their posing before an expected foe with every member of their bodies at rest, and their only weapon of defence as far off as they can possibly hold it. This sentry could not be more defenceless, unless he were lying flat upon his back. A sentry's duty is to watch, to be alert, ready to fire the first shot; in a position for immediate action, or in one indicating that he can act. Perhaps this Pilgrim sentry is looking for the kind of Indians who are represented by the "Indian Hunter," in the same park, by the same sculptor. If so, the Plymouth immigrant has no need of fear or watchfulness, and may strut to his heart's content, for this Indian has his hands full in the careful transportation of his bow and arrows, and the zealous guidance of his dog: a cowardly savage creeping away from his victim, rather than a wily foe

approaching him. If this is the kind of Indian that howled around the Plymouth Colony, the conscious indifference of "the Pilgrim," playing sentry, may be accounted for. If it were a sentry in every respect, it would still lack localization and historical connection, for there is nothing about it to show that it has any positive relation to Pilgrim life in Plymouth or anywhere else.

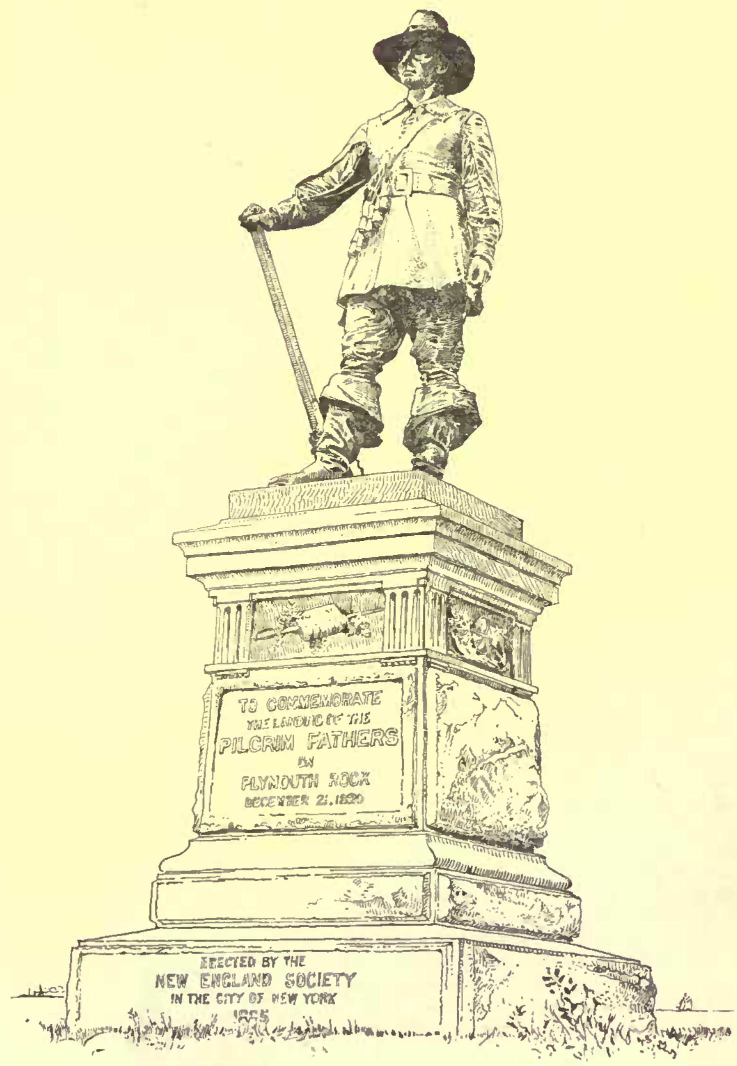
In view of the rich material for sculpture in Pilgrim history, the propriety of selecting a sentry to represent it is as much to be condemned, as this statue is inadequate to make good its name. The necessity of defence against incessant Indian attacks was not peculiar to the Plymouth settlers, but was common to all pioneers in America. It was anticipated by the Pilgrims, and provided for in the person of Miles Standish. Those who are familiar with the pathetic incidents of the Landing, its significant and far-reaching character, and the terrible martyr-life during the first winter after that event, will wonder and be amazed that this statue neither suggests nor

If a gun is to be accepted as the proper symbol that connects the Pilgrims with, and represents them in the new world, their sole arm of defence, their emblem of safety and preservation, upon which their victories were dependent, then this weapon becomes an intimate, essential and governing element of the composition of the statue. It is no more an individual and isolated weapon, it has become the refuge, the defence and the safety of all that is in, or has resulted from the founding of a new and beneficent form of government. It is a great and sacred symbol, as significant in Pilgrim politics as the cross in the Christian religion. The artistic relationship that this symbol bears to the figure of "the Pilgrim," marks the degree of design, of comprehension of subject, and the degree of art that the statue possesses.

If "the Pilgrim" is intended to be "one of the company of the *Mayflower*," it fails to make that intention evident, for there is nothing about the statue to show that it had anything to do with the people who made that ship a pathetic part of history. If it is called by that



The Marquis de Lafayette.[1]



J. Q. A. Werd, Sculptor. "The Pilgrim."

makes allusion to anything connected with these things. Yet there is nothing in history that has a greater variety of subject better defined or clearer in its presentation to the artist than the one this statue undertakes to commemorate. If this statue is to be taken as representing a fighting Pilgrim, it is both unjust to and unrepresentative of that body of persons. They were not fighters with fire-arms, and their gun-carrying was confined to a local and soon outlived part of their history, while their really representative victories were gained with other weapons; and all that characterized them as a distinct body of people, all that comprised their spirit and aims was developed to its full fruition by the exercise of qualities and virtues not even alluded to in this statue.

If the statue is intended to represent a Pilgrim, who, under probable conditions can defend himself against the Indian foe, then the unfortunate position of the right hand is alone sufficient to destroy the entire character of the statue as a composition, for the relation of "the Pilgrim" to his arm of defence is the key-note of the statue.

[1] The statue of Lafayette is introduced to show the effect costume may have on essentially similar compositions.

name because it is supposed to be clothed in Pilgrim costume, it again fails to prove its identity with anything peculiarly Pilgrim, for there is a wide difference of opinion in regard to what this costume really was, and a costume, no matter how well reproduced in sculpture, does not make a statue. Pitiful indeed, would be a subject for sculpture if it had nothing in it but the preservation of a costume. Costume is sometimes a minor corroboration of the identity of a statue, but if it has nothing else but its costume to tell what it is, it is then no more than a manikin. A figure resembling the human form, placed in an attitude that has no intelligible meaning, though clothed in old English costume, has about as much to do with the Pilgrims, as a barrel of old English type has with Elizabethan literature.

It has been said that commemorative statues should not be confined to those who have suffered in the cause of justice; but should also include those who have "goaded martyrs to desperation, and driven them into rebellion." If this statue suggests anything, it is one of the "footmen" employed by King James to "harry the Puritans and Separatists out of the land," rather than "one of the company of the *Mayflower*."

Thus far we have spoken of "the Pilgrim," as an illustration of

delineation of what its name asserts it to be, without special reference to its merits as a work of art. The programme of the New England Society in not wishing to have a statue of any historical individuality belonging to the company of the *Mayflower,* like Carver, Brewster, Bradford or Standish, but "a presentation of a personality belonging to the period and the spirit of the people who moved in it," can be variously interpreted. Its best interpretation calls for an imaginative statue, a symbol in human form, that will embody and clearly represent one of the great events in history, and of a spirit the loftiest that ever actuated a body of human beings. A statue like St. Bruno, by Houdon, or St. Francis, by Cano, statues that are both individual and general, or a statue that "should represent — some episode, principle or belief — identified with the beginning of New England." At least, a Pilgrim, be he saint, sentry or warrior. A work of art, though it has no name. Never was a finer subject to treat, never a broader or richer programme given to an artist.

As a work of art, what has the sculptor produced? "The Pilgrim" as a work of art is, in its conception, meaningless, in its composition, discordant and extravagant; and in its effect pretentious.

It is meaningless, because its composition or attitude conveys no indication that it has any purpose whatever, or is connected with anything in itself as a personality, or outside of itself as representing or alluding to something greater than itself.

It is discordant, because the positions of body, legs and arms do not unite in the performance of any art purpose. It is extravagant, because the body, legs and arms are, in their individual positions, beyond their proper limits in the performance of the purposes for which they are individually and collectively used.

It is pretentious, because the whole composition or attitude is set up as a work of art, though it is not one.

The position of the legs, both bent backward, with the body resting on them, makes a combination not recognized in sculpture as a part of its language, but regarded as undignified and distasteful to both artists and athletes, and only common to weak-kneed youths and men of coarse physical construction. Neither is this position of the legs considered a part of the language of sculpture, unless they are engaged with the body and arms in a transitory and harmonious action, where the arms and body lead or govern the legs, and perform the principal function of the statue. The weak and incongruous legs of "the Pilgrim" are not "the first examples of failure in the handling of these members of the body," by Mr. Ward. It is characteristic of many of his statues. A notable instance is seen in the General Putnam, at Hartford, Conn. Another in the Shakespeare, in Central Park, and still another in the Morgan, at Spartanburgh, S. C.

The position of the body and legs is without the composite support it ought to receive from the arms, and they, failing to give this support, are therefore not only out of harmony with the body and legs, but they are also out of harmony with themselves.

The extravagance of the attitude of "the Pilgrim," and why it fails to produce the impression of dignity and determination may be seen in comparing it with the old Egyptian statue, in wood, of Ra-em-ké. In this statue there is harmony of composition, dignity of presence and art. The dangers and difficulties of employing the legs in positions bending backwards are beautifully shown and well guarded against in the little rude Egyptian statuette in wood. Examples of the bending of both legs backward in their harmonious relationship with the body and arms are seen in the statues of Bichat and Riquet. [See Illustrations.]

The extension of an arm in sculpture is one of the rarely-employed actions of its language. When employed, it concentrates the meaning of the whole statue, and is seen in the expression of command, blessing, appeal, and the consummating periods of oratory. It is essentially an impersonal action, referring to things outside of, beyond and greater than the statue. The extended arm of a pope is the heart-beat of the Roman Catholic world; of an emperor, the ruling of a world; of a general, the command of armies. In "the Pilgrim," it is the care of a gun muzzle.

The perfectly relaxed arm of this statue has about as much to do with the rest of it, as an unused word in a dictionary has with literature. The arm, as a member of the human body, is supposed to be used for some purpose in a statue. When it is in a relaxed position, it may perform the most forcible as well as the most subtle function. It may emphasize repose and dignity, as in Ra-em-ké, or be the starting point of a vigorous action. And the arrangement of the relaxed arm belongs to the highest style of composition. There being no need of the left arm in "the Pilgrim," it is left as a useless appendage to the other parts of the figure.

The attitude or composition of "the Pilgrim" is what is understood among artists as *made up,* and succeeds in producing only the unpleasant impression that the right side of the statue is trying to get away from the left.

Sculpture is no more made by the fanciful placing of the human figure in various positions without the guiding direction of some definite idea, purpose, or conception, than is literature by the use of words without reference to their individual and composite meaning. The purpose of a statue guides the sculptor in the employment of the human figure, as absolutely as the thought of the writer or speaker guides him in the employment of words, and unless the purpose of eth sculptor is expressed in the composition of his work without the help of drapery, it will bear no nearer relation to art than a piece of writing, which depends upon a certain kind of type to express its meaning, will bear to literature.

The best work on this statue is found on the front part of the body above the belt. It comes very near being sculpture, and, if all the figure were as well done as this part, it would be entitled to great praise. There are, however, striking differences of degree. The left arm is badly done, and the half-closed hand is very weak. They both poorly bear comparison with the right arm and hand of the "Farragut," in Madison Square. The work on the knee-breeches and boots shows such determination in copying those articles in the minutest detail, as facts of cloth and leather, that they are robbed of their natural picturesqueness and have become bald reproductions in bronze. The faithful preservation of the cartridge-cases will be far better appreciated by the antiquary than by the artist: the correctness of their reproduction is only equalled by the devices of the cheap French bronze manufacturer, who uses casts from natural objects in place of modelling them from nature. Imitating or copying nature is one thing, and making sculpture out of it is quite another.



St. Bruno. Houdon, Sculptor.

The pedestal upon which "the Pilgrim" is erected is almost as much of a curiosity as the statue. It was designed by Mr. R. M. Hunt, a distinguished New York architect, and is Greek in its style of architecture. If the statue "from afar calls the eye and delights the curiosity with queries as to what manner of manikin it may be," so the pedestal excites a like curiosity as to the kind of architecture produced by a combination of Greek lines and the indigenous grandeur of granite-quarry surfaces. As far as the eye can see this pedestal, and the closer the observer approaches it, the surfaces and lines of the base, plinth and die are obscured and brutalized by the masses of uncut material left upon the sides of these stones. And the supporting dignity which the upper part of the pedestal requires to complete a solid, though not elegant design, is nearly destroyed. If the incongruous composition of the statue should be taken as a guide to explain the reason of this combination of Greek refinement and severity with surfaces of uncut stone that have never formed an element in the development of architecture, however primitive, it would lead to the inevitable supposition that this treatment of the pedestal was suggested by the elevated purity of the purposes of the Pilgrims, and the crude nature of their surroundings on Cape Cod. But what a reason! And what an original point of departure for the exercise of the art of design in architecture. Strange and inartistic as this supposition may be, if correct, the pedestal has still more art in it than the statue, for its scheme is distinct and harmonious, as seen in the preserved lines of the three lower stones, and the completed execution of its upper parts.

The manner of placing an inscription upon a monument, simple and unimportant though it may appear at first thought, is really one of the most puzzling conditions for consideration, though not always beyond the capacity of the common stone-cutter. Here the inscription seems to have been made with the idea of using it for all it was worth; for it can be seen almost as far off as the whole monument can be distinguished, deminating the stone upon which it is placed, impressing the beholder with its undue prominence, and emphasizing the injury already done to the exacting simplicity of the Greek style, by the heavy surfaces of uncut granite.

If the inscription on the pedestal of the Farragut statue is objectionable because of its affected style and the difficulty of deciphering it, that on "the Pilgrim" pedestal is unpardonable, because of its obtrusiveness, to which it obliges every passer-by to submit. Some excuse may perhaps be found for this in the necessity of giving identification to the monument, for without the inscription it would not be known. T. H. BARTLETT.

A STATUE OF THIERS.—While the French have, during the last three months, been erecting monuments and statues to poets, philosophers, generals and sergeants, and all sorts of personages in want of a piece of stone to perpetuate their memory, it seems that there is lying in an obscure atelier at Paris a statue of a great Frenchman, made and ready for erecting, but for which a stand cannot be found. The statue is that of Thiers, the founder of the Third Republic. Several years ago the late M. Clésinger, a first-class sculptor, finished a statue of Thiers, the cost of which was defrayed by public subscription. The family of the sculptor put the statue at the disposal of the Municipal Council of Paris, but that august body refused to erect it on the Place de la Bourse, the site chosen, or anywhere else, though its erection had been decided upon by a decree of the President on the recommendation of the preceding administration. Now an appeal comes from Marseilles for the statue. But Thiers is hardly going to receive honor from his natal town, for it is proposed to stow away the statue in a museum. Fortunately Thiers, having left something behind him, is not so much in need of a statue as some of those who have recently been honored. — *Pall Mall Gazette.*

AN EDITOR'S TRIP ABROAD.[1]—XI.

AMSTERDAM AND THE TOWNS OF NORTH HOLLAND.



DAIS FROM ST. MICHEL. DIJON.

THERE is a certain satisfaction to the tourist in getting a little out of the beaten track of travellers, and to the architect there is a great deal of interest in the quiet old towns of Holland. Americans, particularly, who remember well the important part which the Dutch have had in settling and civilizing their own country, feel that they have a sort of birthright in the "hollow land," and the familiar aspect of the streets and houses, paved and built with the brick which is with them also the normal building material, no doubt contributes to strengthen the sensation of being near home which one experiences in Amsterdam, at least, if not in the smaller towns.

Apart from its similarity to what we are accustomed to regard with the respect due to age and excellent family connections, it may be doubted whether the Dutch brick architecture has much claim upon the artist's devotion, and one cannot, in tracing in nearly every old street in Amsterdam something which might have served as a prototype for a detail in one of Mr. Norman Shaw's London houses, avoid regretting that a man of such capacity should have tied himself down for so many years to the prim, featureless style which William of Orange and his court brought over with them from their quiet canals, to help them with its soporific influence in calming the nerves of the much-distracted Londoners. It is true that he has rebelled now against the rules which he imposed upon himself, and his latest brick houses, if they had been erected upon the Heeren Gracht in year of grace 1688, would have brought their author before the burgomaster for a breach of the æsthetic peace of the community, but it would have been better still if he had trusted from the beginning more to his own devices, and less to those of his great-grandfathers.

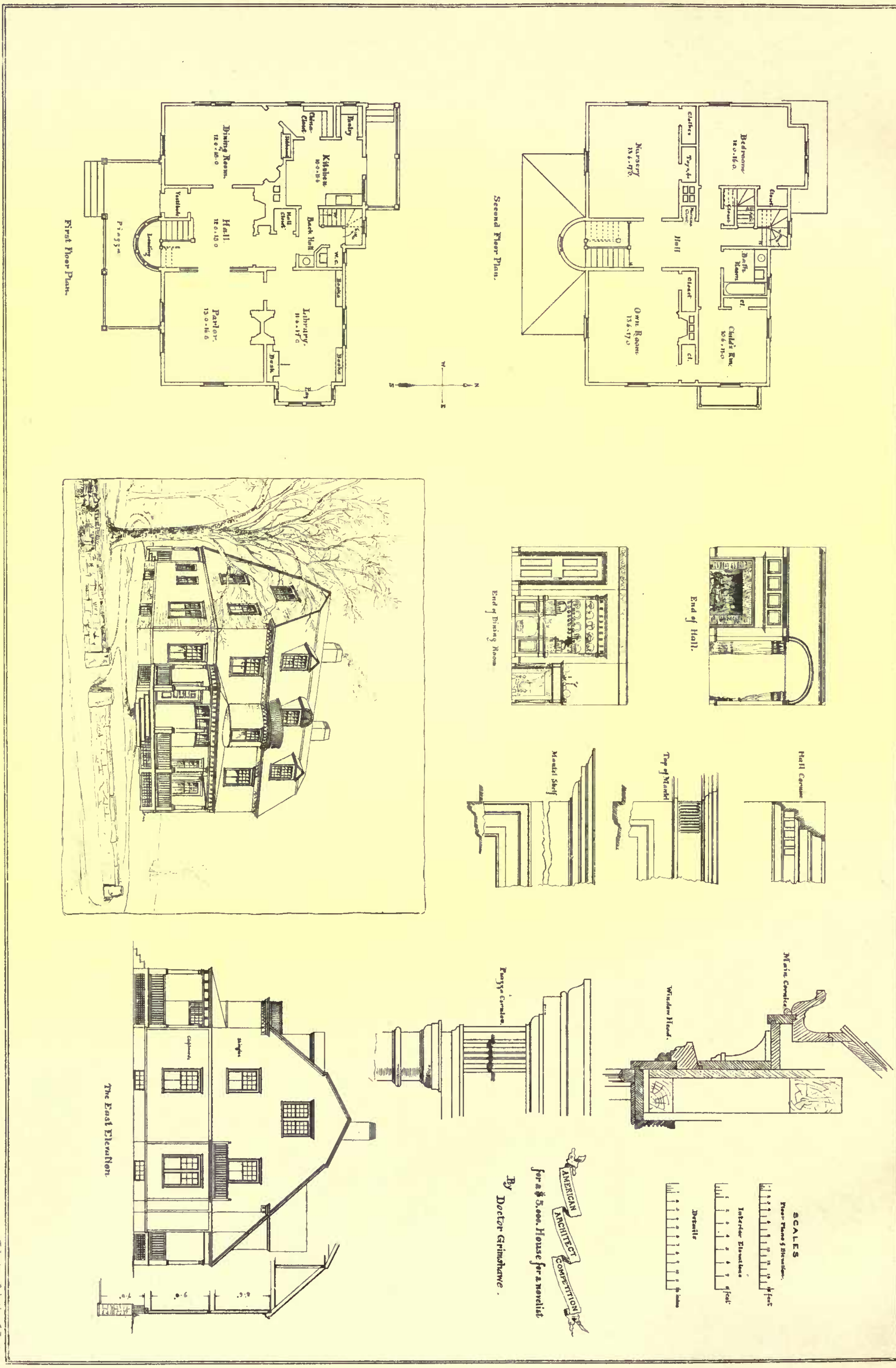
Perhaps the strongest impression given by the old Amsterdam brickwork is that of perfect respectability. It is not very well constructed, for, although the little bricks cling together with astonishing persistence, the houses show many examples of those "arches" of bricks on edge, or, worse still, of those wide openings in the walls, with not even the pretense of an arch over them, which our own ancestors sometimes attempted, so unsuccessfully, to imitate, while the cracked and leaning buildings, and the walls and chimneys tied with iron which one sees on all sides, tell a sad story in regard to the science of their designers; but, however they may bulge and bow, the dark, neatly-painted fronts look always as if their inhabitants had worn ruffs and perukes from time immemorial. A few of the oldest houses show symptoms of a studied proportion of stories and openings, and of a desire on the part of their designers to give them a little character by varying agreeably the sizes and shapes of the windows, and by inserting stone, but they are far between, and with nearly all the openings are arranged exactly as a builder's apprentice would make them, all alike in each story, and equally spaced, and the artistic grace is pasted on afterward in the shape of clumsy festoons, made of cement and stuck on in limited numbers, wherever there was most room for them. In the best houses an inoffensive cornice, with dormers above, terminates the front, but the narrower ones, both ancient and modern, usually have gables, which are mere screens, braced from behind with iron rods, ungainly in shape, and loaded with the coarsest cement scroll-work. In any case the face of the wall which is always of the same rough brick as the interior, and laid with wide joints, is painted as soon as it begins to grow shabby, with a dark slate color, the joints being lined in white or not, as the case may be. The mortar joints are so wide, and the contrast between them and the bricks is so marked, that there is no danger of obscuring them by a coat of paint, but I found in one of the oldest houses that a white line had been put over all the joints, at some remote period, and that this showed through the subsequent coats, which seem to have been rather dressings with colored oil than stratums of paint. In the general painting of the front, the stucco ornaments are not forgotten but receive a coat of white, the same being also put upon the stone bands, key-stones and other decorations, which in the older houses are somewhat liberally used. The basement walls, which are often of smooth slate or marble slabs, need then only a thorough washing to complete the air of decent freshness which the Amsterdam houses, like those in Philadelphia, are seldom allowed to lose. The gloom of the dark paint, even where there is no white stucco or stonework, is nicely relieved by white window frames, and in many houses, particularly the newer ones, the sashes are painted black, forming a narrow, black frame of excellent effect for the white or écru shades, with wide lace edging and insertion, which are commonly used. Several of the less ancient houses, dating, let us say, from the year 1825 or thereabout, have their front windows filled with purple-tinted glass, exactly like that which still survives in some of the old houses facing the Common in Boston, and it seems quite probable that this curious fashion, which appears to have died out completely in a few years, may have been brought to New England from Holland, together with the tiles, and even the bricks, which our grandfathers, and their grandfathers, used to import occasionally. The country around Amsterdam is just what one always fancies Holland to be, a flat, green plain, intersected by endless canals, running off to a multitude of different vanishing-points, and dotted with wind-mills, black-and-white cows, and clumps of bushes, each with a broad, red-tiled roof in the middle; the whole picture being diversified by the shadows of the clouds, which, as in all flat countries near the sea, sweep continually over the sky. There is not much to be said for the beauty of the rustic houses, which are square, one-story structures, with a high hipped roof over them, most of their proprietors making no further sacrifice to the Muse of Architecture than to paint their walls for a space of two feet above the ground of a pale ultramarine color, extending the same decoration, in some cases, to the fences and the trunks of the neighboring trees; but the general effect, to which the beautiful little gardens, and the pretty lace curtains in the windows materially contribute, is one of quiet and intelligent contentment and decency. The picturesque element of the landscape is derived almost wholly from the windmills, which profile very effectively against the sky, and are always so numerous in the flat country as to form an important feature of the scenery. We found more than a hundred in view at once from the train, during the few moments that it stopped at a certain little station, and their silent, deliberate movement counts for a good deal in the impression which the country produces upon the traveller.

After one has grown tired, even of the quiet charm of the region about Amsterdam, there is a diversion within his reach, in the shape of a journey to the northern part of Holland. The guide-books write very meagrely on the subject, and I did not know until I had made one trip by railroad, that it might have been done by steamboat on the canals, but as I learned afterward, it may be taken for granted not only that almost any part of Holland may be reached from any other by water, but that such a mode of locomotion is decidedly preferable to travelling by rail. Although the towns of this region, and of Friesland, which faces it on the opposite shore of the Zuyder Zee, are rather too prosperous to suit the sentimental traveller, there is a great deal that is pretty and interesting, as well as old, in them. Friesland, particularly, has the interest to all English-speaking tourists of being the cradle of the Anglo-Saxon race, and the fierce pirates with yellow hair, who divided England among themselves just before their cousins, the Norsemen, came and took it away from them, still live, in a civilized condition. but with their language little changed, in the plains between the Zuyder Zee and the German frontier. North Holland, which faces Friesland, within an hour's sail, is so different, not only in the language of the inhabitants, which does not much concern the tourist, but in the obvious matters of the costumes and faces of the people, and the character of the architecture, that a very pretty amateur lesson in ethnology may be taken in a day, by dividing it between the two provinces.

At Enkhuizen, once the most important town in North Holland, we found an unexpected amount of architectural entertainment. About three hundred years ago the city contained forty thousand inhabitants, and was not only the metropolis of one of the most fertile districts in Holland, but possessed a great fleet of fishing-vessels, and the prosperous inhabitants, when they built new houses, adorned them with carved stone and stucco, in a way which seems never to have been known at Amsterdam. Not long afterward the mouth of the Zuyder Zee began to close with silt, and the Enkhuizen fishing-vessels, like the Nantucket whalers, found themselves cut off from their harbor. The citizens followed their ships to other ports, the population diminished to one-sixth of its former amount, and, as no one needed to pull down any of the old houses to make room for improvements, they were let alone, and except for the attrition of two or three centuries of weekly scrubbings, they remain nearly unchanged to this day. Many of them have the date, ranging from 1530 to 1630, either in the ironwork or the brickwork, and the older ones, though not the richest, are generally the most delicately and picturesquely designed. Among the later ones, however, there is a great deal of beautifully-carved semi-grotesque stonework, infinitely prettier and more interesting than the clumsy stucco of Amsterdam.

At Leeuwarden, the principal town on the Friesland side of the Zuyder Zee, the character of the buildings is curiously different. We did not have time to stop long at Stavoren, which, although now nothing but a village, is said to have been at one time so rich that the inhabitants locked their doors with bolts of solid gold, and Leeuwarden has always been prosperous enough to pull down its old houses whenever they showed signs of decay, and build fresh ones in place of them; but there is an extremely pretty town-hall, of the sixteenth century, looking much more Scandinavian than Dutch, and a beautiful unfinished Gothic church-tower, which, except for the single circumstance of its being mostly of brick instead of stone, might do duty anywhere in England as a fine specimen of the early thirteenth-century work of that country. Most of the Dutch Gothic architecture that I saw was so deplorable that the sight of this pure and elegant structure was all the more startling, and one could not help wondering whether there might not be a curious story of ancient commercial and artistic relations between the English Saxons and their cousins beyond the Texel, which a closer study of the building could help to disclose. With the exception of these two structures, most of the town is comparatively modern, and the houses, although stone is rather more liberally used in them than in the more southern provinces, and they are more German than Dutch in style, are not particularly remarkable. Friesland, however, is rich in other peculiar characteristics, and Leeuwarden affords an excellent opportunity for studying them. To say nothing of the gold and silver helmets worn by the women, and exhibited for sale by scores in the shop

[1] Continued from page 98, No. 557.

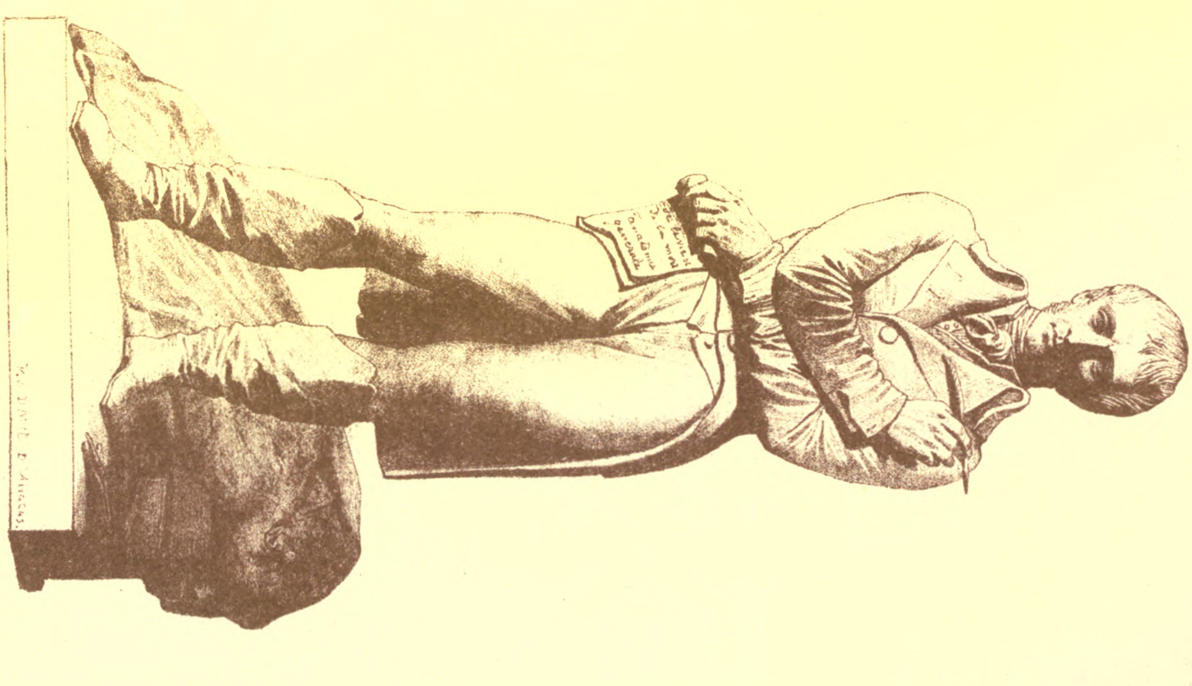


Heliotype Printing Co. Boston.



RIQUET

Béziers 1839 – Souscription Nationale (Bronze)

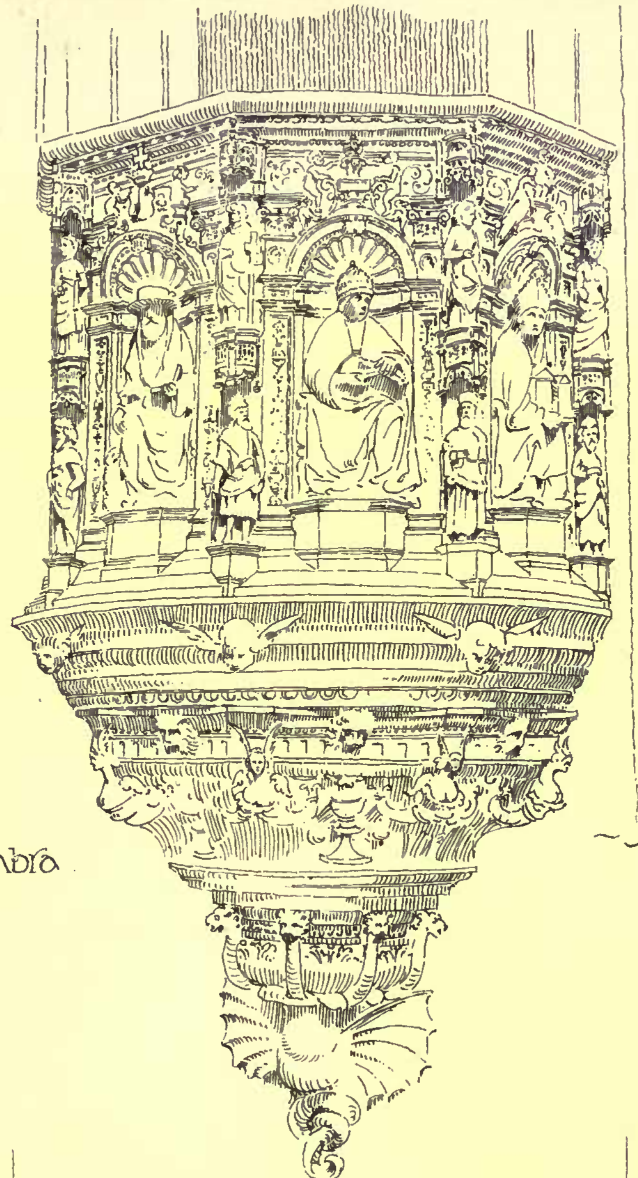


BICHAT

Inaugurée en 1857 à l'Ecole de Medecine Bronze (Souscription Nationale)

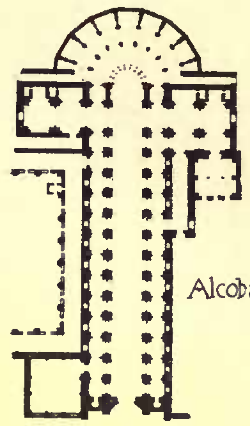
Heliotype Printing Co. Boston

PORTUGUES ARCH



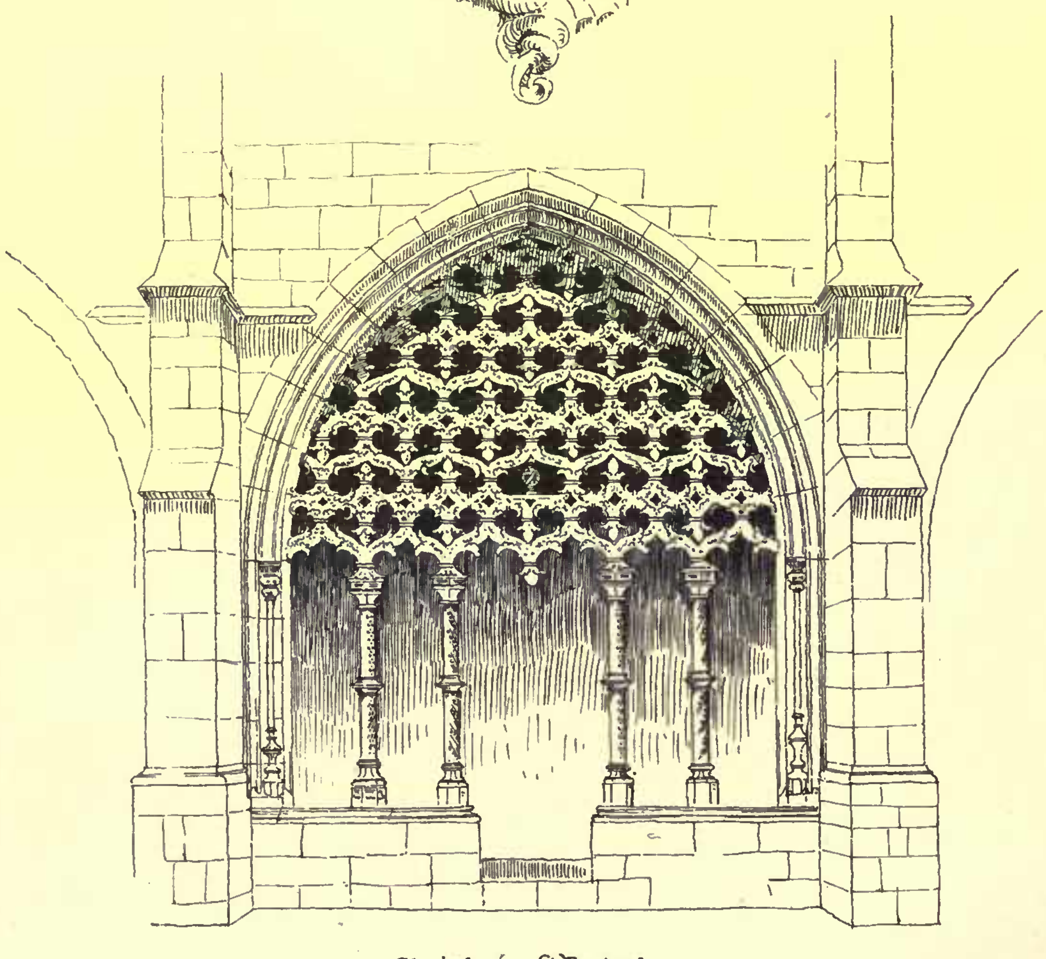
Pulpit at Coimbra

~ Sketched by C·H·Blackall ~

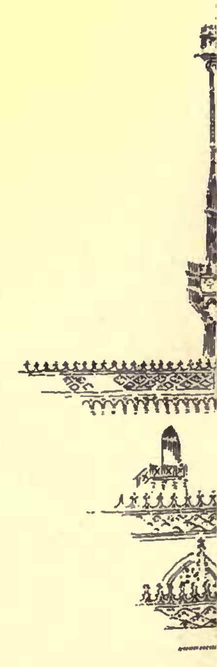


Alcobaca.

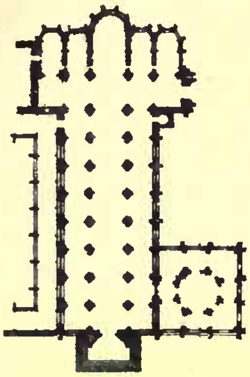




~ Cloister of Batalha ~



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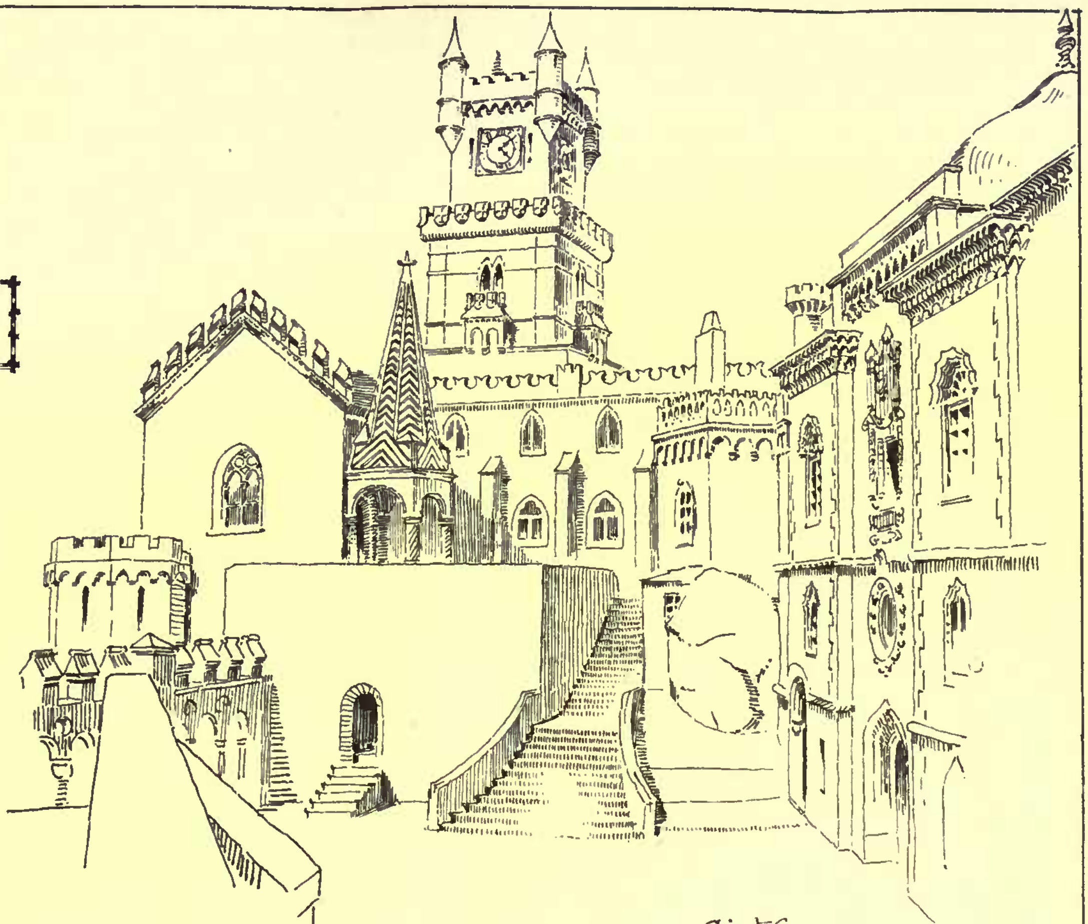


Batalha·

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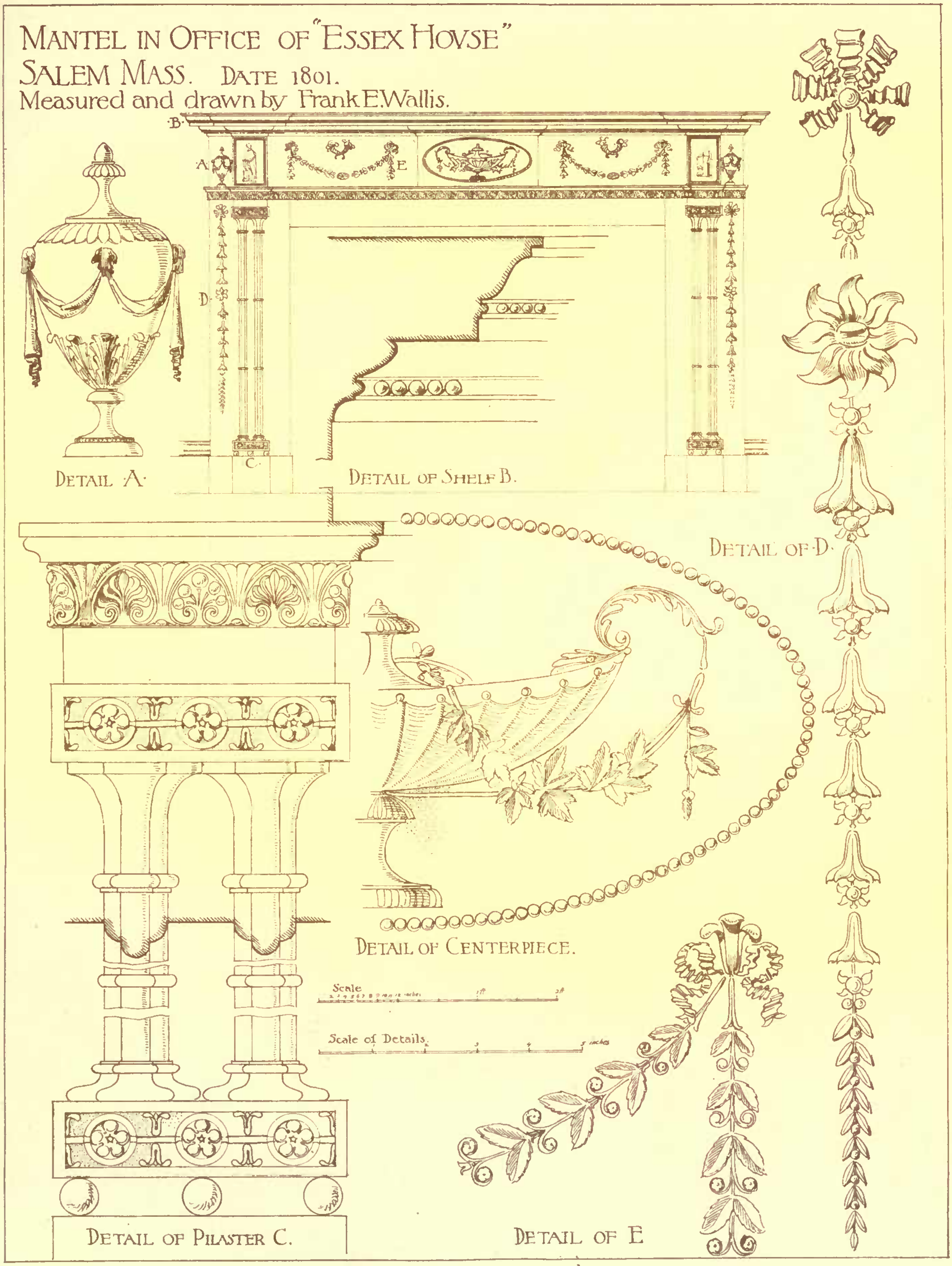
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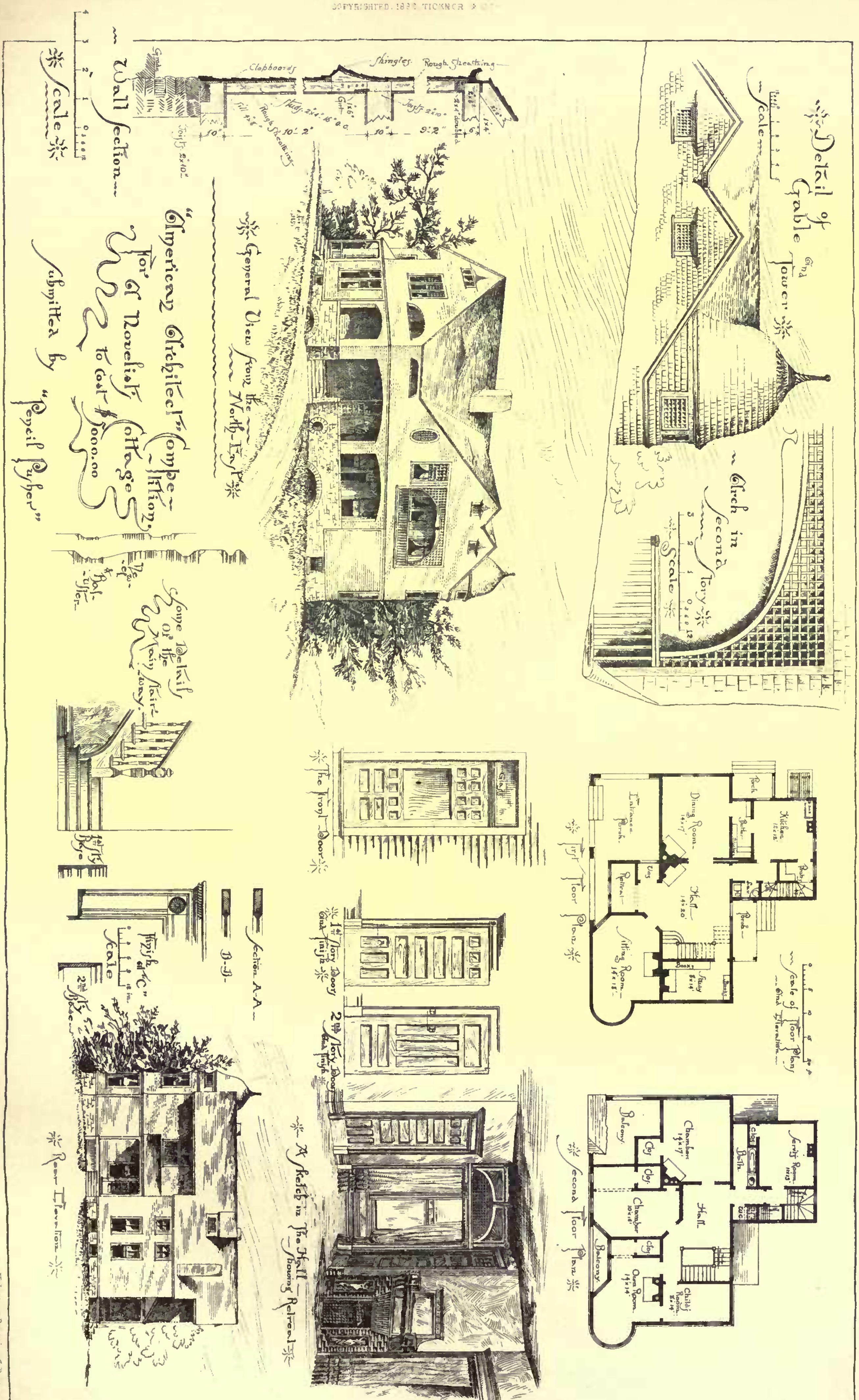


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Old Colonial Work, XIII.



Heliotype Printing Co. Boston

windows, and the other curiosities of costume, the museum contains a collection of local antiquities of remarkable interest, while the dark little *bric-à-brac* shop not far away offers quite as many more, of a sort that could hardly be found anywhere out of Holland, and are not very common even there.

THE ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

COLUMBIA COLLEGE BUILDINGS, MADISON AVE., NEW YORK, N. Y. MR. C. C. HAIGHT, ARCHITECT, NEW YORK, N. Y.

[Gelatine Print, issued only with the Imperial Edition.]

OLD COLONIAL WORK, NO. XIII.—MANTEL IN THE ESSEX HOUSE, SALEM, MASS. DRAWN BY MR. F. E. WALLIS.

STATUES OF RIQUET AND BICHAT.

SEE article on "Early Settler Memorials," elsewhere in this issue. The bronze statue of Baron Riquet at Béziers represents him as studying the project of the Canal of Languedoc. The statue of Bichat, a noted physician and anatomist, also in bronze, stands in the court-yard of the Ecole de Medicine, Paris. Both statues are the work of David D'Angers.

SKETCHES OF PORTUGUESE ARCHITECTURE, — II. BY MR. C. H. BLACKALL, ARCHITECT.

FOR description, see article elsewhere in this issue.

COMPETITIVE DESIGNS FOR A $5,000–HOUSE, SUBMITTED BY "*Dr. Grimshawe.*"

COMPETITIVE DESIGN FOR A $5,000-HOUSE, SUBMITTED BY "*Pencil Pusher.*"

MASONRY.	
Excavation,	$67.00
Footings,	16.00
Foundations,	243.75
Underpinning,	165.00
Hatchway or area,	20.00
Piers and partitions,	39.00
Chimneys,	175.00
Lathing and plastering,	251.75
Cellar bottom,	38.00
Drains,	25.00
Cistern,	30.00
Total of Masonry,	$1,070.50
CARPENTRY.	
Frame,	$405.00
Frame covering,	270.00
Roof,	245.00
Cornice,	35.10
Cellar hatchway,	6.00
Windows,	365.00
Dormer windows,	15.00
Veranda,	176.00
Cellar windows,	17.50
Floors,	148.00
Closets,	18.00
Doors,	386.00
Stairs,	178.00
Base,	48.00
Pantry and butler's pantry,	45.00
Kitchen sink, etc.,	13.00
Tank,	6.00
Bath-room,	18.00
Water-closets,	16.00
Mantels and grates,	290.00
Book-cases,	60.00
Wash-stand and slop-sink,	8 00
Cold-air duct,	12.00
Painting,	220.00
Tinning,	46.50
Plumbing and gas-fitting,	305.00
Furnace,	325.00
Total of carpentry,	$3,677.10
Total of masonry,	1,070.50
Total,	$4,747.60

Leaving a balance of $252.40 for miscellaneous items.

AMERICAN ARCHITECT COMPETITION FOR HOUSE COSTING $5,000.[1]—VII.

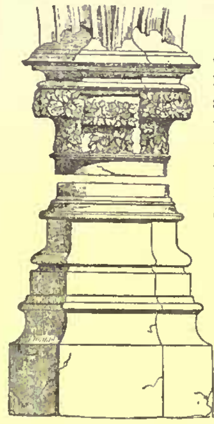
"*Doctor Grimshawe.*" — Plan ordinary. Exterior details attempt to be Classic, but show great ignorance of Classic orders. Necking of column too high; all beads too large. Interior details somewhat better. Exterior design: it is a pity to injure the dignified, simple, old colonial, gambrelled-roof house by the peculiarly ugly combination of porch and round bay shown in this design. This type of house depends upon its absolute symmetry and proportions and its fine Classic detail for its beauty, and the design has destroyed the first and lacked the second qualification for praise. It is the hardest possible type of façade to design well, and requires a very thorough knowledge and a fine artistic sense, neither of which "*Doctor Grimshawe*" appears to possess. Rendering weak.

"*Pencil Pusher.*"— Waste room in hall. Exterior details: eaves too small; water-table too broad. Interior details: cheap and thin; too many small, square panels. Exterior looks more like a stable than a house. Is thoroughly unstudied; all sorts of different-shaped openings of all sizes placed anywhere. Gable tower especially bad; no sense of proportion, masses, shadow or detail in the design, only an unsuccessful attempt to be picturesque. Rendering fairly good.

"*Simplicity.*"— Plan ordinary. Exterior chimneys are seldom — if ever — good, and never with a window in them. Windows badly proportioned — too high for width. Design needs more projection to eaves, and is heavy and stiff in appearance. Interior details bad; rendering labored and uninteresting.

[1] Continued from page 86, No. 556.

PORTUGUESE ARCHITECTURE.[2] — II.



MANY suppose that there is nothing in Portugal to see outside of Lisbon, unless it be Porto, the city of good wines, and it is not altogether surprising that such an idea should have become current. Travelling through the interior of the country is an exceedingly tiresome and tedious undertaking for any one who has not the plethoric purse and the scornful disdain of large bills which is supposed to characterize the typical American abroad. The single line of railway which traverses Portugal north and south from Vigo to Lisbon, was located so as to carefully avoid all the towns which can be said to have any architecture worthy of more than a hasty glance. Leaving the railroad, one has to depend upon the rudest kind of post-carts, to put up with very bad hotels and to pay extravagantly for everything. To judge by the conditions, only two classes of people travel in Portugal: the very poor, who go on foot, and the very rich who go in their private carriages. But one who has the courage and sufficient money to surmount the impediments to provincial travel through the country will find considerable of value to draw from, and any notice of Portuguese architecture would be quite incomplete which confines itself to the city of Lisbon. Indeed, in the metropolis there is practically only one expression of the national architecture, the church at Belem, as the cathedral has been too often destroyed and too thoroughly rebuilt to offer much of interest aside from the general tendencies indicated by its plan.

The largest religious edifice of Portugal is the convent church of Alcobaça, a small village sixty miles north of Lisbon. The monastery was founded during the latter part of the twelfth century by Don Alfonso of Burgundy, the first sovereign of Portugal. It was built on a very extensive scale. The refectory could accommodate nine hundred monks at table, and the number of cells was as high as nine hundred and ninety-nine. A plan of the church is given on the sheet of sketches. The reason for the excessive proportions of the nave is stated to be the fact that all the monks were obliged to assist at the services each day. Indeed, the disposition of the plan would seem to indicate that the church was designed only for the use of the monks, and was intended to consist essentially of a space for the altar, and a single, long choir. The transepts are so reduced in importance that they seem more like double chapels, the width being only 7.23m, while the total distance across the church at the intersection is 57.60m. The length of the church is 105.30m, and the width of the nave 22.35m. The semi-circular *chevet* and the radiating chapels are a later addition, having been built in 1676, four hundred and fifty years after the church proper was completed. The original termination was probably square. It is worth noting that with the exception of the Lisbon Cathedral there is not a church of any importance in Portugal, antedating the seventeenth century, in which the circular apsis was used. It is the more singular in the present instance as the founder of the monastery was a Frenchman and the five monks who traced the first plans were sent to Portugal from France.

Neither the exterior nor the interior of Alcobaça has any special artistic merit. The style is early Gothic, quite simple in all its parts and somewhat imposing from the dimensions given it. The pointed arch was used for the first time in Portugal in this church. The simplicity of the internal disposition and the comparative absence of the florid overloading which is so prominent in most of the Portuguese churches, show very clearly that although the plan may indicate no foreign influence, French taste presided over the design and left the architecture plain, even at the expense of interest. In the chapel adjoining the south transept is a well-designed tomb enclosing the remains of Don Pedro and Inez de Castro, two royal lovers who are as celebrated in Portuguese literature as Abelard and Heloise have been in France. It is the single piece of richness Alcobaça possesses and is cited as the most beautiful tomb in the kingdom, being carved with the delicacy of ivory and composed with a great deal of taste. In the same chapel is the tomb of Don Alphonso, the ancient law-giver of Portugal.

Twelve miles beyond Alcobaça is the hamlet of Batalha, possessing a monastery and church dedicated to *Nuestra Senhora da Vittoria*, erected in 1388 by Joâo I, in honor of a victory over the Castillians at Aljubarrota, by which the independence of Portugal was assured and the monarchy established on a firm basis. The Portuguese architects are very proud of Batalha and consider it as one of the most perfect types of Gothic art in Europe. Perhaps, that would be stating the fact considerably stronger than most Frenchmen would admit, but the church is certainly a worthy effort and deserves more serious study than it has thus far received. The Portuguese naturally claim it as entirely their own, and with much reason, for Alfonso Henriques, a Lisbon architect, is known to have personally directed the work, and his immediate successor was also a Portuguese. Hence it is fair to consider the plan[3] as being Portuguese, and for that matter, comparing it with the plan of the church at

[2] Continued from page 60, No. 554.

[3] Access was had to the plans which are reproduced with this article, through the courtesy of the Chevalier J. P. N. da Silva, Architect to the King of Portugal.

Alcobaça, erected two centuries earlier, it will be seen that the two are much alike except in the disposition of the choir chapels, and there is nothing at Alcobaça to show that the two plans may not have originally terminated in the same manner. But as to the exterior of Batalha there can be no denying the strong outside influence and it is easily traced. The wife of João I, was Philippa, daughter of the Duke of Lancaster and grandchild of Edward III. According to Murphy, an English architect who visited Batalha in 1789, the design, as far as relates to the façade at least, was inspired from that of York Cathedral, and was due to a certain Stephen Stephenson who was brought from England by the Queen. One thing is certain, that the front of the church is as English as anything could be outside of England, and that whoever made the plans, the design was directed by English ideas.

The church has been so affected by successive earthquakes that the floor of the nave is now several feet below the average level of the surrounding country, and but for the active care of the government the portal would long ago have been choked up with sand. A general view of the church is given with the sheet of sketches. The façade is simple and dignified in its proportions. A wide portal enclosed in a pointed arch and ornamented with a quantity of figure-carvings forms the entrance to the church. Above is a single window corresponding to the clerestory of the nave and on each side a graceful, mullioned opening marks the aisles. The sketch is on too small a scale to indicate the character of the ornament, but the squared sky-lines, the rectangular buttresses and the foliated cornices, as well as the perpendicular fillet ornamentation of the wall-surfaces about the central openings, all reveal the English element of the design. The façade is a very satisfactory one to study, both in detail and in general effect. It seems well-regulated and orderly, the work of a mind which was perhaps a little too accustomed to thinking with T-square and triangle, but which was by no means blind to quiet refinement. It does not impress in exactly the same manner as does the façade of Rheims, or as some of its own possible prototypes in England; but it has a subdued charm which is none the less agreeable by contrast with some of the work which is more purely Portuguese in character. Well would it have been for the national character if subsequent constructions had followed more closely the example so well set forth in this instance. As it was, the monastery church of Batalha exerted a considerable influence on Portuguese ideas and the Gothic which was used in later times leans more strongly to English forms than in any other direction, while even the Belem church, which was the crowning example and the last of the line, retains the flat roof and the rectangular sky-lines of Batalha.

The structure at the right of the façade is the chapel of the founder, completed in 1434 and enclosing the tombs of João I, and Philippa of Lancaster. This chapel was originally crowned by a lofty pyramid of stone after the design of that shown over the transept at the left of the sketch, but it having been thrown down by an earthquake, the government has never yet seen fit to restore it, and perhaps with reason for the general effect of the church is harmonious now and it is doubtful if an aggressive spire at the right would be any improvement.

As will be seen by the plan, the nave of the church is three-aisled The transept is even less pronounced than at Alcobaça and the church ends with five parallel chapels. The width of the nave is twenty-two metres, and the height under the centre of the vaulting 32.46m. The total length from the entrance to the back of the central chapel or choir is 79.39m. A peculiarity of the arrangement is that there is no high-altar, properly so called, each of the five chapels having its altar and the central one being only a little larger than the others and dedicated to the Virgin.

The cloisters which adjoin the church to the north are interesting in detail in a manner which can be but imperfectly shown by the sketch. The two influences, English and Portuguese, are very plainly manifested here. The circumscribing arches, the mouldings, the buttresses and the engaged colonnettes with their caps and bases are thoroughly English; while nothing could be more characteristically Portuguese than the slender, isolated shafts and the fantastic net-work of leaf-like tracery filling the heads of the arches. As an effect of color it is most strikingly picturesque, with its grave, sober setting and its sparkling, lace-like filling. Finely-carved stonework is often compared to lace, but rarely can one find work which so truly fits the comparison as in Portugal, and especially here in this charming cloister. The stone is of a clear, creamy yellow, almost white, which catches every ray of sunlight and emphasizes each shadow, giving a warm lustre to the whole.

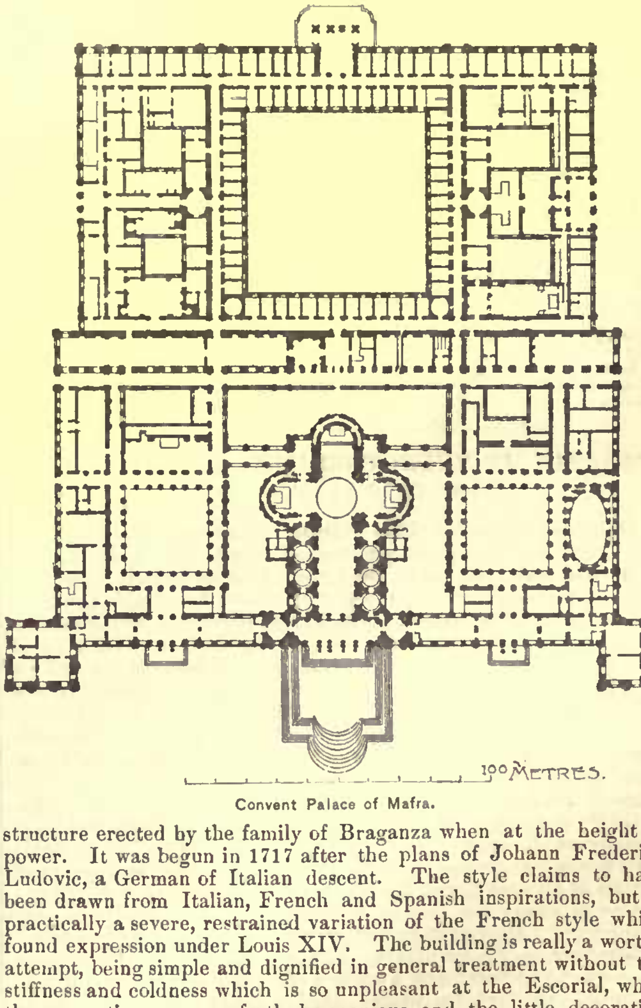
Behind the church is an unfinished chapel in the most florid late Portuguese Gothic, with rich bays carved to the last degree of delicacy and with the beginnings of a hardy vault which was to cover the whole in a single span. This chapel was built by Don Manoël, the patron of Vasco de Gama, and when the explorer returned triumphant from his long voyage the Infante left this chapel as it now stands and taking all his workmen to Lisbon began the erection of the Belem church. The favor which Batalha had enjoyed up to that time began to wane, and the edifice slowly fell into sad neglect. During four centuries no systematic care was taken of it and the monks rather aided the dilapidation by injudicious alterations, but of late years it has been thoroughly restored and is now regularly sustained by the government.

A little over fifty miles to the north of Batalha is the city of Coïmbra, third in importance in Portugal. It is the seat of the government university and abounds in historical associations and souvenirs but is quite poor in architecture, the college buildings offering little of interest and the cathedral being a showy edifice in the Jesuit style. In the convent church of Santa Clara, however, is a chef-d'œuvre well worth visiting, in the shape of a large pulpit, magnificently carved, cut from a single block of marble and built into the wall of the church. A sketch of it is given herewith. The details of this pulpit are really excellent; the seated figures in the niches are full of character and the bas-reliefs and numerous arabesques are sharply cut and spirited in design. The florid fancy which sometimes seems so incongruous when spread over the entire façade of a building is quite in place in this single piece of carving. The pulpit springs from a wall completely covered with fine old glazed tiles in deep-blue figured designs of continuous scroll-work and architectural forms, presenting a most striking and unique effect of color, a combination such as one would find nowhere but in such a country as Portugal.

There are two remaining churches which are worthy of consideration: the cathedral of Braga, the bishop of which is the primate of Portugal, and the cathedral of Porto. The interest in each is chiefly related to the plan. The cathedral of Braga is the most ancient religious edifice in Portugal. A church was erected during the first century of our era, according to tradition, but the foundations of the present cathedral date from towards the close of the tenth century. The building was completed in 1112. During succeeding centuries it was so altered and worked over that all traces of the original style have disappeared, though the plan is believed to be essentially as it was in the twelfth century. The choir, which was made over in the sixteenth century in the style of the convent church of Belem may possibly be a deviation from the original disposition. As will be seen by the plan the cathedral consists of a single, three-aisled nave sixty-eight metres long and twenty metres wide. The transepts disappear almost entirely and the arrangement of the eastern chapels would indicate that this plan was a prototype of the church at Batalha. The exterior of the cathedral is of no artistic value.

The cathedral of Porto dates from about the beginning of the twelfth century, but like the previous example, has been so much modified that only the plan remains of the original edifice, and even this is not entirely certain, as the choir, which in disposition is so widely different from the other Portuguese churches, was built or at least reconstructed during the seventeenth century. The length of this cathedral from the portal to the back of the choir is 64.70m and the width 15.30m.

Eighteen miles to the north-west of Lisbon is the palace, monastery and church of Mafra, the Escorial of Portugal, an immense



Convent Palace of Mafra.

structure erected by the family of Braganza when at the height of power. It was begun in 1717 after the plans of Johann Frederick Ludovic, a German of Italian descent. The style claims to have been drawn from Italian, French and Spanish inspirations, but is practically a severe, restrained variation of the French style which found expression under Louis XIV. The building is really a worthy attempt, being simple and dignified in general treatment without the stiffness and coldness which is so unpleasant at the Escorial, while the proportions are perfectly harmonious and the little decoration employed is correct and scholarly, even if inclined to be slightly monotonous. In fact it is a design over which one could never feel the slightest enthusiasm, though it is thoroughly in keeping with its

character and with the spirit of the age in which it was erected. The stories of the building of this immense edifice make one think of Versailles. Rome, Venice, Milan, Holland, France, Liege and Genoa were set to work preparing details of the ornamentation. During thirteen years, over 20,000 workmen were daily employed about the building, and during four months of 1730, 45,000 persons were inscribed on the pay-rolls. There were days when 2,500 carts were occupied in bearing material to Mafra. It was the first and last truly gigantic building enterprise in which the country engaged.

The plan is admirably arranged to suit the conditions of the problem. The entire façade measures two hundred and twenty metres. In the centre is the church, seventy-eight metres in length; on the right are the apartments of the King, on the left those of the Queen with the state and reception rooms in the two side wings; while in the rear are the cells and apartments pertaining to the monastery, grouped about a large open court.

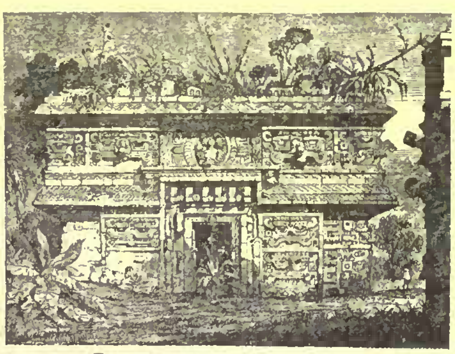
The influence of so important a building upon the architecture of the country was quite marked, and when the great earthquake destroyed Lisbon and Don Santos de Carvalha was commissioned to rebuild it, from Mafra were drawn all the ideas for the new work, and all that has been done in the country since has followed the same general style.

There remains only one building to be noticed. At Cintra, a few miles to the west of Lisbon, is an interesting old convent-castle, picturesquely grouped on the summit of a steep, rocky hill, presenting a pleasing mixture of Gothic, Moorish and early Renaissance and offering a curious picture of what a fortified, mediæval, Portuguese monastery might have been. When the order of the Templars was suppressed in every other country in Europe, the Knights found a lodging and a welcome in Portugal, and they may have aided in the planning of the Cintra monastery, to judge by the shields and heraldic devices which form a portion of the decoration. Don Fernando, the father of the present king, caused the edifice to be thoroughly restored and adopted Cintra as his summer residence. The view shown by the sketch is taken in the outer court and will illustrate the confused and heterogeneous but picturesque character of the buildings.

Portugal can not at all compare with Spain in architectural interest. There is comparatively little to see and what there is must be studied judiciously; but the traveller who is visiting Spain can well afford to spend one, two or even three weeks in Portugal, and will find to reward him an architecture differing in some respects from anything else in Europe, and abounding in ideas capable of being adapted with advantage to quite different circumstances and offering suggestive thoughts well worth taking back to America.

C. H. BLACKALL.

SAFE BUILDING.[1]—VII.



FROM CHICHEN-ITZA. YUCATAN.

The deepest beam the most economical. One thing is very important, and *must be remembered*, that the *deeper* the beam is, the more economical, and the stiffer will it be. If the beam is too shallow, it might deflect so as to be utterly unserviceable, besides using very much more material. As a rule, it will therefore be necessary to calculate the beam for deflection as well as for its transverse strength.

Safe deflection. The deflection should not exceed 0,″03 that is, three one-hundredths of an inch for each foot of span, or else the plastering would be apt to crack, we have then the formula:—

$$\delta = L.\ 0{,}03 \qquad (28)$$

Where δ = the greatest allowable total deflection, in inches, at centre of beam, to prevent plaster cracking.

Where L = the length of span, in feet.

In case the beam is so unevenly loaded that the greatest deflection will not be at the centre, but at some other point, use:—

$$\delta = X.\ 0{,}015 \qquad (29)$$

Where δ = the greatest allowable total deflection, in inches, at point of greatest deflection.

Where X = the distance, in feet, to *nearest* support from point of greatest deflection.

If the beam is not stiffened sideways, it should also be calculated for lateral flexure. These matters will be more fully explained when treating of beams and girders.

COMPARATIVE STRENGTH AND STIFFNESS OF BEAMS AND COLUMNS.

Strength of beams of different cross-sections. The comparative transverse strength of two or more rectangular beams or cantilevers is directly as the product of their breadth into the square of their depth, provided the span, material and manner of supporting and loading are the same, or

$$x = b\ d^2 \qquad (30)$$

Where x = a figure for comparing strength of beams of equal spans.

Where b = the breadth of beam, in inches.

Where d = the depth of beam, in inches.

Example.

What is the comparative strength between a 3″ x 12″ beam, and a 6″ x 12″ beam? Also, between a 4″ x 12″ beam, and a 3″ x 16″ beam? All beams of same material and span, and similarly supported and loaded.

The strength of the 3″ x 12″ beam would be

$$x_{I} = 3.\ 12.\ 12 = 432.$$

The strength of the 6″ x 12″ beam would be

$$x_{II} = 6.\ 12.\ 12 = 864, \text{ therefore,}$$

the latter beam would be just twice as strong as the former.

Again, the strength of the 4″ x 12″ beam would be

$$x_{III} = 4.\ 12.\ 12 = 576$$

and the strength of the 3″ x 16″ beam would be

$$x_{IIII} = 3.\ 16.\ 16 = 768.$$

The latter beam would therefore be $\frac{768}{576}$ or just $1\frac{1}{3}$ times as strong as the former, while the amount of material in each beam is the same, as

$$4.\ 12 = 3.\ 16 = 48 \text{ square inches in each.}$$

The reason the last beam is so much stronger is on account of its greater depth.

Strength of beams of different lengths. The comparative transverse strength of two or more beams or cantilevers of equal cross-section and material, but of unequal spans, is inversely as their lengths, provided manner of supporting and loading are the same. That is, a beam of twenty-foot span is only half as strong as a beam of ten-foot span, a quarter as strong as one of five-foot span, etc.

Stiffness of beams of different lengths. The stiffness of beams or cantilevers of same cross-section and material (and similarly loaded and supported), however, diminishes very rapidly, as the length of span increases, or what is the same thing, the deflection increases much more rapidly in proportion than the length; the comparative stiffness or deflection being directly as the cube of their respective lengths or L^3.

That is if a beam 10 feet long deflects under a certain load one-third of an inch, the same beam with same load, but 20 feet long will deflect an amount x as follows:

$$x : \tfrac{1}{3} = 20^3 : 10^3, \text{ or } x = \frac{20^3 . \frac{1}{3}}{10^3} = \frac{8000}{3000} = 2\tfrac{2}{3}''$$

Stiffness of beams of different cross-sections. The comparative stiffness, that is amount of deflection of two or more beams or cantilevers, similarly supported and loaded, and of same material and span, but of different cross-sections, is inversely as the product of their respective breadths into the cubes of their respective depths or

$$x = \frac{1}{b.d^3} \qquad (31)$$

Where x = a figure for comparing the deflection of beams of same material, span and load.

Where b = the breadth of beam, in inches.

Where d = the depth of beam, in inches.

[1] Continued from page 64, No. 554.

GLOSSARY OF SYMBOLS.—The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.:—

- a = *area*, in square inches.
- b = *breadth*, in inches.
- c = constant for *ultimate resistance to compression*, in pounds, per square inch.
- d = *depth*, in inches.
- e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
- f = *factor-of-safety*.
- g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
- g_{I} = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
- h = *height*, in inches.
- i = *moment of inertia*, in inches. [See Table I.]
- k = *ultimate modulus of rupture*, in pounds, per square inch.
- l = *length*, in inches.
- m = *moment or bending moment*, in pounds-inch.
- n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
- o = the *centre*.
- p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
- q = the *amount* of the *right-hand re-action* (or support) of beams, in pounus.
- r = *moment of resistance*, in inches. [See Table I.]
- s = *strain*, in pounds.
- t = constant for *ultimate resistance to tension*, in pounds, per square inch.
- u = *uniform load*, in pounds.
- v = *stress*, in ponnds.
- w = *load at centre*, in pounds.
- x, y and z signify *unknown quantities*, either in pounds or inches.
- δ = *total deflection*, in inches.
- ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
- $\mathfrak{d}$ = *diameter*, in inches.
- $\mathfrak{r}$ = *radius*, in inches.
- π = 3.14159, or, say, 3.1-7 signifies the *ratio of the circumference and diameter of a circle*.

If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_{I}, a_{II}, a_{III}, etc., or b, b_{I}, b_{II}, b_{III}, etc.

In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance:—

- m = moment or bending moment at *centre*.
- m_A = " " " *point A*.
- m_B = " " " *point B*.
- m_X = " " " *point X*.
- s = strain at *centre*.
- s_B = " *point B*.
- s_X = " *point X*.
- v = stress at *centre*.
- v_D = " *point D*.
- v_X = " *point X*.
- w = load at *centre*.
- w_A = " *point A*.

Example.

If a beam 3″ x 8″ deflects 0′,5″ under a certain load, what will a beam 4″ x 12″ deflect, if of same material and span, similarly supported and with same load?

For the first beam we should have

$$x_{,} = \frac{1}{3.8^3} = \frac{1}{1536} = 0{,}00065$$

For the second beam we should have

$$x_{,,} = \frac{1}{4.12^3} = \frac{1}{6912} = 0{,}00014$$

The deflection of the latter beam will be as

$$\delta : 0'',5 = 0{,}00014 : 0{,}00065, \text{ or } \delta = 0'',108$$

Strength of beams of different lengths & cross-sections. The comparative strength of rectangular beams or cantilevers of different cross-sections and spans, but of same materials and similarly loaded and supported, is, of course, directly as the product of their breadth into the squares of their depths, divided by their length of span, or

$$x = \frac{b.d^2}{L} \qquad (32)$$

Where x = a figure for comparing the strength of different beams of same material, but of different cross-sections and spans.
Where b = the breadth, in inches.
Where d = the depth, in inches.
Where L = the length of span, in feet.

Stiffness of beams of different lengths & cross-sections. The comparative stiffness or amount of deflection of different rectangular beams or cantilevers of same material, and similarly loaded and supported, but of different cross-sections and spans, would be directly as the cubes of their respective lengths, divided by the product of their respective breadths into the cubes of their depths or

$$x = \frac{L^3}{b.d^3} \qquad (33)$$

Where x = a figure for comparing the amount of deflections of beams of same material and load, but of different spans and cross-sections.
Where L = the length of span, in feet.
Where b = the breadth, in inches.
Where d = the depth in inches.

Strength and deflection of wooden beams, one inch thick. If it is desired to calculate a wooden girder supported at both ends and to carry its full safe uniform load, and yet not to deflect enough to crack plaster, the following will simplify the calculation:

TABLE VIII.

	Spruce.	Georgia pine.	White pine.	White oak.	Hemlock.
Calculate (x) for transverse strength only if d is greater than	$1\frac{1}{6}L$	L	$1\frac{1}{19}L$	$1\frac{1}{5}L$	$\frac{14}{15}L$
Calculate ($x_{,}$) for deflection only if d is less than	$1\frac{1}{6}L$	L	$1\frac{1}{19}L$	$1\frac{1}{5}L$	$\frac{14}{15}L$

Where L = the length of span, in feet.
Where d = the depth of beam, in inches.
Where x or $x_{,}$ = is found according to Table IX.

To find the safe load (x) or ($x_{,}$) *per running foot of span*, which a beam supported at both ends, and 1″ *thick* will carry, use the following table. (Beams two inches thick will safely carry twice as much per running foot, as found per table, beams three inches thick three times as much, four inches thick four times as much, etc.)

TABLE IX.

	Spruce.	Georgia pine.	White pine.	White oak.	Hemlock.
If calculating for transverse strength only use	$x = 111\left(\frac{d}{L}\right)^2$	$x = 133\left(\frac{d}{L}\right)^2$	$x = 100\left(\frac{d}{L}\right)^2$	$x = 122\left(\frac{d}{L}\right)^2$	$x = 83\left(\frac{d}{L}\right)^2$
If calculating for a deflection (not to crack plaster) use	$x_{,} = 95.\left(\frac{d}{L}\right)^3$	$x_{,} = 133\left(\frac{d}{L}\right)^3$	$x_{,} = 95\left(\frac{d}{L}\right)^3$	$x_{,} = 100\left(\frac{d}{L}\right)^3$	$x_{,} = 89\left(\frac{d}{L}\right)^3$

Where x = the safe load in lbs., per running foot of span, which a beam one-inch thick will carry regardless of deflection, if supported at both ends, and
$x_{,}$ = the same, but without deflecting the beam enough to crack plaster; for thicker beams multiply x or $x_{,}$ by breadth, in inches.

Calculate for either x or $x_{,}$ as indicated in Table VIII.
Where d = the depth of beam, in inches.
Where L = the length of span in inches.

If a beam is differently supported, or not uniformly loaded, also for cantilevers, add or deduct from above result, as directed in matter following Table VII.

Example.

A floor of 19′ *clear space is to be built with spruce beams, to carry* 100 *lbs. per square foot; what size beams would be the most economical?*

According to Table VIII, if $d = 1\frac{1}{6}.\ L = 1\frac{1}{6}.\ 19 = 22\frac{1}{6}''$ we can calculate for either deflection or rupture and the result would be the same. If we make the beam deeper it will be so stiff that it will break before deflecting enough to crack plastering underneath; while if we make the beam more shallow it will deflect enough to crack plaster before it carries its total safe load. The former would be more economical of material, but, of course, in practice we should certainly not make a wooden beam as deep as 22″. Whatever depth we select, therefore, less than 22″, we need calculate for deflection only. We have, then, according to Table IX, second column,

$$x_{,} = 95.\left(\frac{d}{L}\right)^3$$

If we use a beam 12″ deep, we should have

$$x_{,} = 95.\frac{12^3}{19^3} = 24$$

or a beam 1″ x 12″ would carry 24 lbs. per foot; as the load is 100, lbs. per foot we should need a beam $\frac{100}{24} = 4\frac{1}{6}$ wide, or say a beam 4″ x 12″, and of course 12″ from centres.

If we use a beam 14″ deep we should have

$$x_{,} = 95.\frac{14.^3}{19^3} = 38$$

or a beam 1″ x 14″ would carry 38 lbs. per foot, we need, therefore, a beam of width

$$b = \frac{100}{38} = 2\frac{12}{19}''$$

or we must use a beam say 3″ x 14″ and 12″ from centre, or a beam 4″ x 14″ and 16″ from centre. For if the beams are 16″ from centres each beam will carry per running foot $1\frac{1}{3}.100$ lbs. = 133 lbs. and a 4″ x 14″ will carry per foot

$$4.x_{,} = 4.38 = 152.$$

We could even spread the beams farther apart, except for the difficulty of keeping the cross-furring strips sufficiently stiff for lathing.

Of course the 14″ beam is the most economical, for in the 12″ beam we use 4″ x 12″ = 48 square inches (cross-section) of material, and our beam is a trifle weak. While with the 14″ beam we use only 3″ x 14″ = 42 square inches of material, and our beam has strength to spare. The 4″ x 14″ beam 16″ from centres would be just as strong and use just as much material as the 3″ x 14″ beam 12″ from centres. If we wished to be still more economical of material, we might use a still deeper beam, but in that case it would be less than 3″ thick and might twist and warp. If the beam is not cross-bridged or supported sideways it might be necessary to calculate its strength for lateral flexure. That it will not shear off transversely we can see readily, as the load is so light, nor is there much danger of longitudinal shearing, still for absolute safety it would be better to calculate each strain.

Strength of columns different lengths. The comparative strength of columns of same cross-section is approximately inversely as the square of their lengths. Thus, if x be the strength of a column, whose length is L, and $x_{,}$ be the strength of a column whose length is $L_{,}$, then we have *approximately*

$$x : x_{,} = L_{,}^2 : L^2, \text{ or } x_{,} = \frac{x.\ L^2}{L_{,}^2} \qquad (34)$$

Where $x_{,}$ = approximately the strength of a column, $L_{,}$ feet long.
Where x = the strength (previously ascertained or known), of a column of same cross-section, and L feet long.
Where L and $L_{,}$ = the respective lengths of columns in feet.

The nearer L and $L_{,}$ are to each other the closer will be the result.

Strength of columns different cross-sections. The comparative strength *per square inch* of cross-section of columns of same length, but of different cross-sections, is, approximately, as their least outside diameter, or side, or

$$x : x_{,} = b : b_{,}, \text{ or } x_{,} = \frac{x.\ b_{,}}{b} \qquad (35)$$

Where $x_{,}$ = approximately the strength of a column, per square inch, whose least side or diameter (outside) is = $b_{,}$.
Where x = the strength per square inch (previously ascertained or known) of a column of same length, but whose least side or diameter (outside) is = b.

The more similar and the nearer in size the respective cross-sections are, the closer will be the result. That is, the comparison between two circular columns, each 1″ thick, will be very much nearer correct than between two circular columns, one $\frac{3}{4}$″ thick and the other 2″ thick, or between a square and a circular column. The thicker the shell of a column the less it will carry per square inch. The formulæ (34 and 35) are hardly exact enough for safe practice, but will do for ascertaining approximately the necessary size of column, before making the detailed calculation required by formula (3).

The approximate thickness required for the flanges of plate girders is as follows:

Approximate thickness of flange of plate girders.

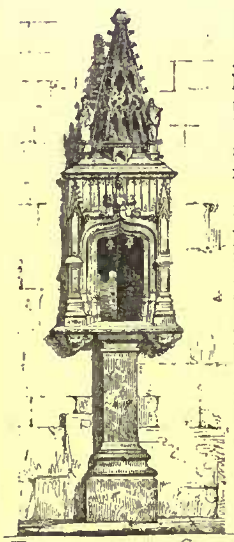
$$x = \frac{\frac{\mathfrak{r}}{d} - a_{,}}{b} \qquad (36)$$

Where x = the approximate thickness, in inches, of either flange of a riveted girder.
Where b = the breadth of flange, *less rivet holes*, all in inches.
Where d = the total depth of girder in inches.

Where r = the required moment of resistance at a given point of girder in lbs. inch. (see formula 18.)

Where a_1 = the sum of the areas of the two angles securing flange to web, *less rivet holes*, in square inches.

THE RESTORATION OF ST. MARK'S, VENICE.



TABERNACLE IN THE CHURCH AT MIREBEAU.

SINCE the time when the repairs on St. Mark's excited such furious obloquy and stormy discussion little has been heard, says a correspondent of the *Times*, of the restorations on the great buildings of Venice. One might suppose that they had at that day been inaugurated, and that as a result of the English denunciations the repairs were stopped, while the simple fact is that, according as means permitted, the work has been going on ever since 1840, and that before that at various times the Venetian Republic had restored and rebuilt as the stability of St. Mark's required. A curious evidence of this was three or four years ago brought to light. In repairing the façade of the portico of the church a large stone tablet was removed, disclosing on its hidden face a long inscription containing a treaty between two Cretan cities. This inscription was sent to Professor Comparetti, who recognized in it a lost inscription which was unsatisfactorily transcribed in Venice about two hundred years ago, and has never since been seen, until the recent repairs in the façade of St. Mark's re-discovered it.

The fact is, as I showed in a letter which was a contribution to the discussion above alluded to, that St. Mark's was built by men who were admirable artists, but wretched builders; it was built probably in parts, and without any appreciation of the artistic importance it should one day have, or much care for the elements of stability requisite for the prolonged existence it has enjoyed. In the renewal of the little pavilion at the south-west angle, which is only attached to the church at one side, but serves as a flying-buttress, and bears the thrust of the outer walls of the two chapels on that side, the foundations were found on excavation to consist of piles about six feet long, on which was laid a mass of uncemented rubble a yard or two thick (I do not now recall the exact thickness then stated to me by the architect, now deceased), and on this the bases of the columns were laid. As lately the accusations brought during the old discussion have been authoritatively repeated, and as the work is now being completed, I think it may be worth while to restate the substance of what I then said as to the reasons for demolishing and reconstructing this corner of the church. The wall on the south side of the southern aisle had split from top to bottom from the wretched quality of the material, both brick and mortar, and from the use of sticks of fire-wood, which had been used in the piers as binding material and, perhaps, to save masonry. The mortar had almost lost cohesion, the bricks could be rubbed to dust by the fingers, and the wood had not waited to be rubbed, for nothing but dust remained of it. The outer pier of the south-west pavilion was sinking from the insufficiency of the foundation, and the whole south wall of the two chapels had long been prevented only by extensive shoring-up from falling into the piazza and carrying with it the vault of the chapel, and with it all that face of the south aisle wall which was detached from the inner face by the cleft I have spoken of, as well as everything which supported from without the vault of the south aisle. This crack was getting worse in spite of the shoring and the braces and ties which had been applied from within.

The whole outer wall of the chapels and the entire pavilion was taken down, the brick masonry inside it repaired as well as possible, and solid foundations being prepared, the pavilion and wall were rebuilt, the marbles, which formed a thin shell over the brickwork, and the columns, entablatures, etc., of the original structure being restored as far as the stone cohered still; the vacant places were filled by pieces of the same material as the original where it was attainable, and where not by the nearest substitute for it. The old sculptured material was all preserved intact and restored to its original position. The columns, corroded on the sea side, were turned round so that a new surface was exposed; not an old stone that was utilizable was rejected, and only the incrustation of marble plates was renewed and two or three columns. This was the condition in which I saw it. The Chevalier Meduna, who, with his elder brother, had been in charge of the church for half-a-century and reverenced every stone in it, has followed his elder to the grave, and the works are now in charge of another not less conscientious and reverential architect, Dr. Pietro Saccardo, who has his hoarding now around the pavilion, to complete the work of Meduna by restoring the marble shell in places where the new structure had not in Meduna's day settled to its bearings, and now receives its new coating of marble. Saccardo has gone farther in some details than did Meduna, because he has by diligent search found fragments enough of the various marbles employed by the early builders to be enabled to remove the substitutions made by Meduna, and replace them with material identical with the old—the verde di Genoa by the verde antica, and the grey Italian marble by the original grey Greek. But so difficult to obtain were these, that the latter, which was in the original used in slabs, has been cut into very thin plates, which are cemented on substantial slabs of marble of Carrara, fastened with nickle bolts, and then this compound plate is cemented in its place. The old south wall of the chapel was disfigured by a sixteenth-century tomb which Meduna had removed, restoring the wall to keeping with the whole façade, but in the substituted material. This Saccardo has removed, putting in its place the genuine antique material as elsewhere. The veneering of the south-west angle of the chapel and the south doorway remain to be completed, and the church will then be freed from the scaffolding; but if any person with an eye to symmetry and the grace of the structure will look at the corresponding north-west pavilion, he will see it sinking in the same way below the level of the body of the structure, and only held to it by a complication of iron bars, which drag on the building itself, and make the pavilion to be a burden instead of a support as it should be. This should be corrected; but, as less immediately imperative than the south-west pavilion, so the renovation will make less apparent change, the marbles there being in incomparably better state than were the old ones on the other angle. The only visible external restoration beyond those now mentioned are the correction of the cornice which, with the partial and unequal subsidence of the façade had taken a wavy line more indicative of the picturesque than the stable, and which is now a straight line the entire length of the cornice.

The mosaics of the chapel, against the renewal of which so much outcry was made, have been completely changed, and the old mosaics, which were cleft and riven in scores of fragments, the glass cubes of which they were composed being in many cases wanting at both sides of the fracture for an inch or more in width across the whole subject, have been repaired with the best art of the mosaicist, and replaced on the walls of the chapel, only one composition of the entire series being absolutely irreparable, and being replaced by a new mosaic composed on the very slight indications of the old one. I have just been over the work carefully, and, without the indications of the mosaicist, should not have been able to determine which is the new among the old, so perfectly has the spirit of the design, and the tints of the old been followed. On this point I have the testimony of an architect and decorator of reputation, who, after seeing what had been done, avowed, enemy though he was of the restoration, that the new work was practically in all points as good as the old, though he added, "I would not tell them so, not to encourage them in going any farther."

But, in spite of all partial repair, the cathedral is slowly sinking into "the mud of the lagoons," the tide ebbs and flows up under the great dome, and yesterday I saw the water standing on the floor of the crypt, which was walled in and cemented only a few years ago, it was hoped impermeably. The earth on which the church stands is being slowly washed out by the flow and ebb, and the foundations of the church are unequally subsiding. The old piers of the first church which are under the nave and transept, bearing no weight, do not sink equally, and are lifting the floor into waves, which make it perilous walking on it, and which are increasing perceptibly, it seems to me. Nothing can stop this but the sinking around the entire church of a solid, impermeable wall to keep out the salt water, within which the foundations may be made as stable as the site will permit; or the inner face of the foundations must be laid bare, and the entire area of the church must be excavated and similarly treated, after which the floor-level may be restored, and the pavement, with its invaluable decorative designs, rescued from the destruction it is now undergoing. In many places the mosaics are already effaced under the tread of visitors' feet; the people who stigmatise the restorer of those which have been preserved being among the most eager to denounce any attempt to preserve them by the only means which will suffice, *i. e.*, copying them in solid workmanship while enough of the original remains to follow the design. This is in some places already impossible, but most of the patterns are still practically complete.

I want particularly to insist on the fact, utterly ignored or denied by the denouncers of the restorations, that these are purely structural, only undertaken where the stability of the church is impaired, or the destruction of its decorative qualities threatened. But for the general system of repairs so long going on, the whole church would in all probability have been before this a mass of ruin. In all that has been done there has been, it seems to me, no needless renovation, and the old sculptural work has always been restored to its place without being scraped or cleaned except by washing with water, the plain marbles and undecorated parts of columns being alone polished to preserve the stone from the action of the elements, the old carious surface inviting decomposition. The Republic employed men to scrub the stone and keep it clean from the accumulation of dirt and incipient vegetation which disfigure it and imperil its surface; more than this its successors do not propose, and less they cannot safely do. The Government allows only £2,000 a year for the repairs, etc., of St. Mark's, which is much less than Austria allowed. In my unprofessional opinion this, if insufficient, is, as far as it goes, well and wisely spent. Only an architect can criticize the technical appliances, and this I made no attempt to do; but, as far as the æsthetic result is concerned, I do not see how any fair-minded person who respects the artistic character of the church can find fault with what has been done, if he will only take pains to find out how much and what it is.

COMMUNICATIONS

THE ALLEGHENY CEMETERY COMPETITION.

PHILADELPHIA, Aug. 31, 1886.

To the Editors of the American Architect:—

Dear Sirs, — Our attention having been called to an inquiry in your columns concerning the competition for new entrance to the Allegheny Cemetery at Pittsburgh, Pa., we would inform your correspondent that our design has been selected and that we have been employed to carry out the work.

Respectfully, etc., HENRY A. MACOMB.
JOHN J. DULL.

EYE-BARS.

August 31, 1886.

To the Editors of the American Architect:—

Dear Sirs, — In the last number of the *American Architect* in the article on American bridge-building you use the term "eye-beam." Some time ago I came upon the same term spelled in the same manner and upon looking it up in books published by Iron Companies I find but one that spells it in this way. Should it not be designated "I-beam" as its sectional shape is like the capital letter I? Would not the word "eye" convey an entirely different shape to one's imagination? I ask for information as opinions seem to differ on this point. Very truly yours, FRANCIS CRAIGIN.

[OUR correspondent must have read as carelessly as he copied. We spoke of eye-bars not eye-beams, and did not refer to I-beams (we follow the accepted usage whenever we have occasion to speak of rolled beams) but to the tension members of trusses which are connected with chords or other members by an eye and bolt. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

THE ELECTRICAL TRANSMISSION OF FORCE. — During the last ten years M. Marcel Deprez has been engaged in experiments connected with the transmission of force by means of electricity. The Rothschilds, some time since, provided him with an unlimited credit to prosecute his researches at Creil, under the inspection of a commission of thirty-eight men of science. On Friday the Commission met to hear a report on the results at present obtained, drawn up at their request by M. Maurice Lévy. This report was unanimously approved. It appears from it that we can now, with only one generator and only one receptor, transport to a distance of about thirty-five miles a force, capable of being used for industrial purposes, of fifty-two horse-power, with a yield of forty-five per cent, without exceeding a current of ten ampères. When the amount of force absorbed by the apparatus used to facilitate the recent experiment, but not required in the applications to industrial purposes, is added, the yield will be nearly fifty per cent. The Commission certifies that the machines now work regularly and continuously. The maximum electro-motive force is 6,290 volts. Before the construction of the Marcel Deprez apparatus the maximum force did not exceed 2,000 volts. The report states that this high tension does not give rise to any danger, and that no accident has occurred during the past six months. The Commission is of opinion that the transmitting wire may be left uncovered on poles provided it be placed beyond the reach of the hand. It estimates at nearly £5,000 the probable cost of the transmission of fifty horse-power round a circular line of about seventy miles. This price would, however, be much diminished if the machines were frequently constructed. The Commission, in the name of science and industry, warmly congratulated M. Deprez on the admirable results which he had obtained, and expressed thanks to the Rothschilds for the generous aid extended to the undertaking.— *Correspondence London Times.*

CANADIAN LIGHT-HOUSES.— The annual report of the Canadian Minister for Maine and Fisheries states that the number of light-houses on the Canadian coasts is 526, in addition to 617 fire-signals, 23 steam fog-whistles, and 12 automatic fog-horns. The light-house service comprises the six divisions of Ontario, Quebec, Nova Scotia, New Brunswick, Prince Edward Island, and British Columbia. The Ontario division comprises the fixed and floating light-houses in that part of the Province of Quebec included between Montreal and the frontier line which separates the Provinces of Quebec and Ontario, as well as all the fixed and floating light-houses in the province of Ontario itself — that is to say, the lights on the St. Lawrence above Montreal, and on the Lakes of Ontario, Erie, Simcoe, Superior, Huron, and Georgian Bay. At the end of last year there were 171 light-houses in this division, including 2 in Manitoba, several having been erected last year, and the total annual cost of their maintenance was £14,200. The Quebec division comprises the fixed and floating light-houses of Montreal and those situated lower down the St. Lawrence, on the river Richelieu and Lake Memphremagog, as well as all the floating light-houses, steam-whistles, buoys, etc., in the Gulf of St. Lawrence, the Straits of Belle Isle, and the northwest coast of Newfoundland. When navigation closed for the winter there were in that division 149 fire-signals, 8 floating light-houses, 3 of which were provided with steam-whistles, 7 steam-whistles, or fog-horns, 10 fog-guns, 107 buoys, 59 beacons, and 9 life-boat stations. The annual expenditure in this division is about £28,600. In the Nova Scotia division there are 152 light-houses, 163 fire-signals, 1 floating light-ship, 12 steam-whistles, 8 hand-whistles, 2 fog-bells, 3 fog-guns, 9 automatic signal-buoys, 5 sounding buoys, 84 ordinary buoys, 430 mastheads, and other small buoys, 7 fixed beacons, 8 lifeboat stations, 3 relief stations, and 4 signal stations. The annual expenditure in this division is about £27,400. The New Brunswick division comprises all the light-houses, whistles, buoys, and beacons situated upon the coast and rivers of that province, there being 100 fixed and 2 floating light-houses. The annual expenditure is about £20,000, and £1,600 was spent last year in new lighthouses. In the Prince Edward division there are 45 fire-signals, the total annual cost being about £4,000; while in the division of British Columbia there are 8 fire-signals and a steam-whistle, the annual expenditure being £3,000.— *Building World.*

TRADE SURVEYS

THE continued improvement in the railroad situation over what it was a year ago is the basis for the improving confidence in railroad, manufacturing and business circles. Railroad earnings are improving on all important lines of traffic. July earnings were the most satisfactory for three years. Much is expected to grow out of our anticipated gold importations. Better rates of interest are realized under the expanding demand. The gold movement will be checked so far as artificial expedients will allow. The export trade in cereals, petroleum, provisions, lumber and in manufactured products will be heavy. Importations especially of dry-goods and certain forms of iron and steel will be in excess of last year. The outflow of industrial capital from eastern financial centres to the West and South continues and offers of financial assistance are made from London. The success with which the railroad companies and pools are meeting in maintaining friendly relations is helping on the good order of things. A great many investors imagine that a railway-war means that we have reached the limit of safe railroad construction, an altogether unfair inference. There are at this time demands for upwards of thirty million dollars for railroad building purposes in Wall Street and other financial centres. It is not probable this large sum could be or will be spared at this time, but enough will be spared to make the year 1887 a phenomenal one in railroad construction unless all signs fail. Inquiries have been made for over one hundred thousand tons of steel-rail for next year's delivery, a very significant fact indeed. Fortunately, railroad material cannot advance. Never before in our history were projectors and builders so assured against an advance in prices. In all other seasons of great activity the possibility and probability of sudden and unjustifiable advances acted as a terror to enterprise. Vast enterprises have been handicapped and loss sustained thereby. Trade reviewers overlook this feature of the present situation. There is another to which too little attention is given, viz., that the price of labor, which heretofore has been uncertain, fluctuating between wide limits will hereafter be more constant and fluctuate within much narrower limits. Enterprise can therefore see farther and calculate with more safety. The volume of business is not unusually large at the opening of the autumnal season. The volume of requirements is greater than at any previous period. Demand therefore, whether it be gradual or abrupt, will discover strong prices. Perhaps the safest authority in Chicago on trade prospects says the improvement is gradual only but of a character which denotes further improvement, and like that which preceded the boom of 1881, is likely to culminate in better things than it is at present given credit for. There is a certainty of a good export demand. The demand for all kinds of raw and finished material is good. One plate-glass works (at Creighton, Pa.,) with a capacity of 13,000 square feet per week is refusing orders for delivery before October 1. Window-glass is scarce. Lumber demand is again swelling. Common grades of lumber have been advanced $1.00 per m. at St. Paul, Minneapolis, and other Northwestern points. The period of weak prices has passed in all markets. Buyers are looking up supplies in both Western and Eastern markets before an advance takes place. The sash, door and blind manufacturers and the planing-mill interests generally are sharing in the increasing activity.

House-building activity is the basis of the steady demand and good prices. Large orders for freight-cars are to be given out during the next two weeks. Reliable reports are at hand from the Middle and several Western States to the effect that nearly all the available freight-cars of the several trunk lines are taxed to their utmost capacity to move the merchandise offering for shipment. Hence, there are no fears of the pools going to pieces. Prospects were never better for permanent harmony among the railroads than now, but the uncertain foundation is a satisfactory traffic demand. The demand for machinery is heavy. A score of large establishments have just started to run over-time for a few weeks. Textile manufacturers are busier than ever, and jobbers report greater demand during August than since 1882, when demand was largely stimulated by the fear of advancing prices. The coal production continues in excess of last year, and new territory is developed. Prices are stronger in anthracite than two weeks ago, and producers are predicting a further improvement in October. In real-estate matters, business is dull in Boston, New York, Philadelphia and Chicago. Agents and owners in these and other cities are inclined to hold prices up, in view of the favorable prospects for next year. The views of architects and builders are as heretofore expressed, viz., that the demand for new buildings next year will go ahead of its record this. The permit lists during the last two weeks of August were rather light, and conveyances fell off also; values, however, are improving. It is probable that a speculative movement will be developed in suburban real estate in several Western cities; at least, this possibility is intimated by conveyancers and real-estate lawyers, who have been watching the course of city real estate in the interest of investors and builders. There are no indications that too many houses are being built. In New York city, land is being quietly purchased for extensive operations and improvements next spring. In Philadelphia, certain large building sites have been bid for. In Pittsburgh a reaction from this year's dullness is assured. In the Ohio Valley a great revival will take place early next year. The industries are exceptionally prosperous and the development in the South is shining with a reflected light throughout the Ohio Valley. It is safe to invest in building and in industrial operations. Even in those industries where competition has wiped out margins for a year or two past, improvement is observable. Last year's investments have not been disappointing. Small houses are paying seven to fourteen per cent. Larger houses, five to ten. Material is low and abundant. Labor strikes are causing very little annoyance or delay. Wages will remain stationary for months. No further agitations are contemplated for shorter hours and will not be undertaken in any event except under the auspices of the Knights of Labor, who are known to be not in entire sympathy with the movement.



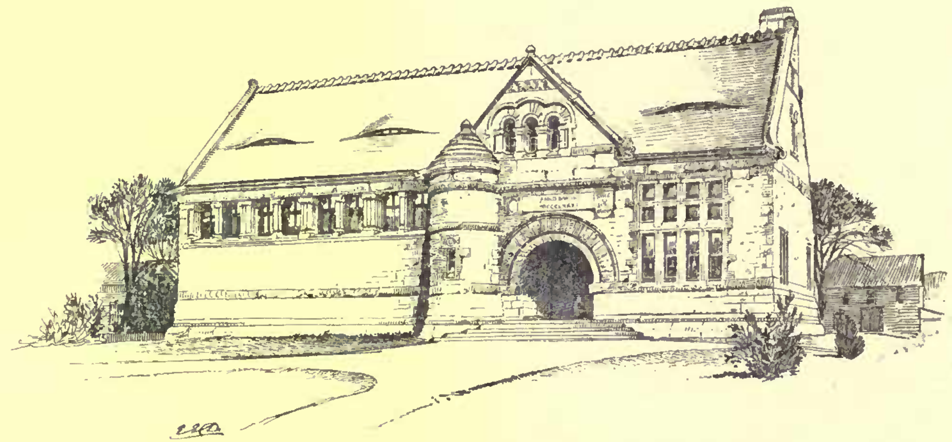
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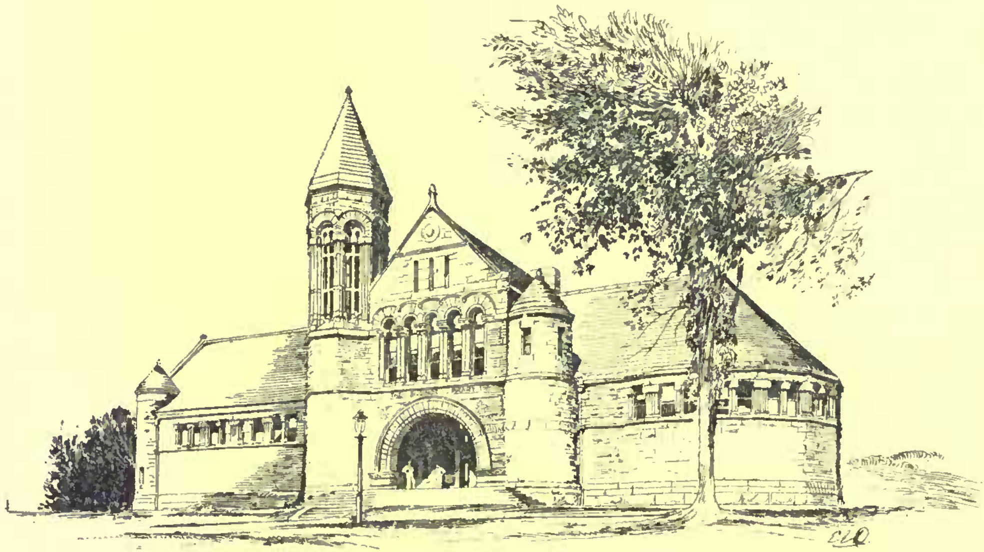
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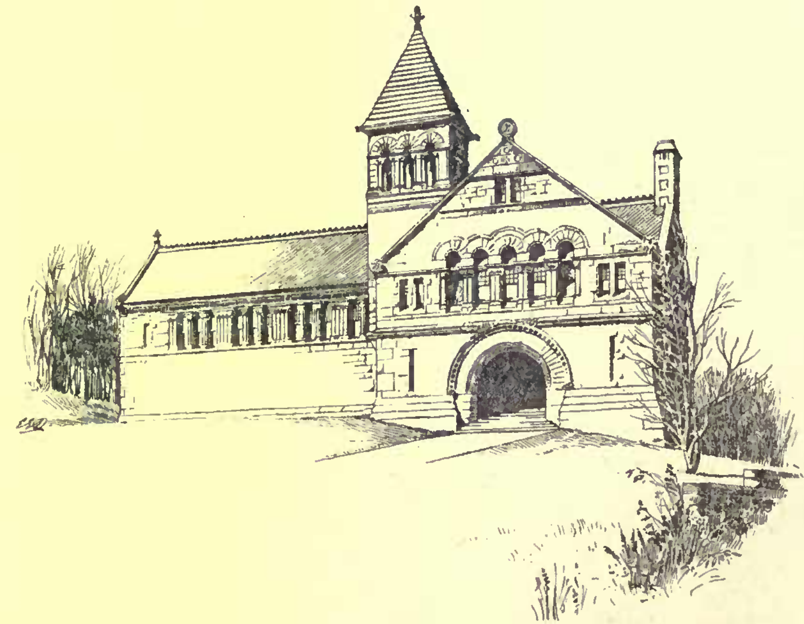
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CONTENTS

NATURALLY the series of earthquakes which last week laid waste Charleston, S. C., and other places, has caused architects to reflect on how desirable it might be to consider seismic disturbances in completing work now in hand or in designing new work. As no country has yet discovered a style of building which is proof against earthquake shocks of every intensity, and as our social habits and our climate obviously prevent our following the methods most successfully employed in earthquake countries, it does not seem to us that architects need to reckon with a special factor-of-safety for earthquakes, at least not until experience has shown that subterranean disturbances are likely to find frequent relief by volcanic upheavals in this part of the globe. Except in the case of the tallest of modern buildings, any well-built structure that we are now in the habit of putting up would be likely to resist a shock as successfully as any building, equally adapted to every-day use and specially built, not with the idea of being absolutely earthquake-proof, but as affording a reasonable security for danger at a time of earth tremor. It seems to us that the matter is one to be regarded rather from the fatalist's point of view, who may be supposed to argue thus: "Earthquakes are always possible. It is hardly possible to build an earthquake-proof structure. I shall be just as dead if a one-story building falls on me as if I received my quietus from the fall of a ten-story one. I cannot have all the modern conveniences in a one-story building, and I cannot derive the income from it I can from a ten-story building. If I do not build a high building my neighbors will, and I might as well be killed by my own bricks-and-mortar as by theirs." Ordinary substantiality of building is all that, in most cases, the majority of architects and property-owners will think it necessary to undertake, and we think that the chances of such structures would have of resisting an earthquake-shock would be about as great as those of buildings specially designed and built to be earthquake-proof. Nevertheless, we believe that the disaster will certainly have an effect in curtailing the exorbitant height of future city buildings, and we are not such pessimists as not to feel hope that there will be on account of it a marked tendency to improve the construction of the average buildings everywhere.

THE most useful of the grosser building tools is unquestionably the crane, and the best of the American cranes are good enough for all ordinary kinds of work; but there are cases where the matter of time is an all-important factor, and any crane which economizes time in its evolutions should be introduced to the attention of all builders. *Le Génie Civil* gives an interesting account of quick-working cranes built on the system Borde, and particulars of the latest improvement on the original type as employed by M. Georges Averly, of Lyons, in building a viaduct at Dombief, which is well worth describing. In place of the usual mast, boom and guys familiar to all of us, M. Averly uses a framework very like the scaffolding of a pile-driver, and sixty-eight feet high. Pivoted at the top of this framework, and at the middle of its own length, extends, on either side, the arms of a bow-string lattice girder, seventy-four feet long, carefully balanced and moving like the walking-beam of a steamboat. The stationary engine on the platform below has two sets of hoisting-drums, from one of which runs the hoisting-rope, which passes over a fixed sheave at the head of the framework, and then along to a pulley at the end of, say, the right-hand arm of the tilting girder. The other drum winds up what we will call the halyard. This rope passes from the drum over a fixed sheave, which is fastened to the lower part of the frame, and is thence carried out to another fixed block at the end of the left-hand arm, and is then brought back and made fast to the frame at a point distant from the top of the frame somewhat less than the length of one arm of the girder. It is plain that when the engine winds-up the halyard the left-hand arm is depressed, and the right-hand arm is elevated, so that a load suspended from that arm is, without further ado, raised from the ground a distance equal to the height of the end of the right-hand arm above the axis of revolution. But, meanwhile, the hoisting-drum has been winding, in the hoisting-rope, and the result is, that when the right-hand end of the lever has reached its highest altitude, the load has practically reached the same point. That is, that while the end of the lever has risen through a distance of about thirty-five feet the load has in the same time risen through a distance of about one hundred and three feet. The enormous economy in time effected is apparent at a glance. The platform on which the whole apparatus is built revolves at need under the impulse of the engine, and as the whole thing stands on a track laid parallel to the face of the work, and over which it is moved also by the same engine, it is plain that the apparatus can reach every part of the work and accomplish all necessary evolutions. As to economy of money, a comparison, made in 1858, of the work of a much less perfect apparatus with the usual method of building, showed that an actual saving of eighty per cent had been effected.

THE difficulty between the New York master-plumbers and their journeymen is seemingly a more needless one than usual, and the question whether the business really belongs to the men or to the masters is certainly no less prominent than it has been in recent labor troubles. The masters have resolved that apprentices must be at least sixteen years of age; must read and write English, and understand the four cardinal rules of arithmetic; must serve five years, and must be under the sole control of the masters. The journeymen insist that a master may take only one apprentice for every four journeymen he employs; that the selection of apprentices be subject to the journeymen's association; that for the first three-and-a-half years of their apprenticeship they serve under the journeymen, and finally that all hands under twenty-four years of age shall be paid at least two-dollars-and-a-half per day. The only excuse we can see for the position taken by the journeymen is that they may fear that the masters may fill their shops with indentured apprentices, and so deprive the journeymen of their chance to earn a living; but as they must know that any plumber who did this would speedily lose his custom, we cannot look on the matter in any other light than as one more attempt to prove that so long as a given man does his own work and hires no man to do it for him, he is a holder of property and property rights, but that just so soon as he hires a laborer, his property and property rights pass to the man he hires, and he no longer has a voice in the direction of his own affairs.

THE courts are evidently to play an important part in these labor troubles, and if cases can only be brought in such form that a ruling can be arrived at, labor-reformers and their victims may learn with speed that the law can make short work with the sophistries of union leaders and club orators. Every one felt a doubt whether boycotting could be suppressed by law, and the labor-employing classes felt relief when one court after another found that boycotting cases could be punished as conspiracies. It is now to be discovered whether the law can

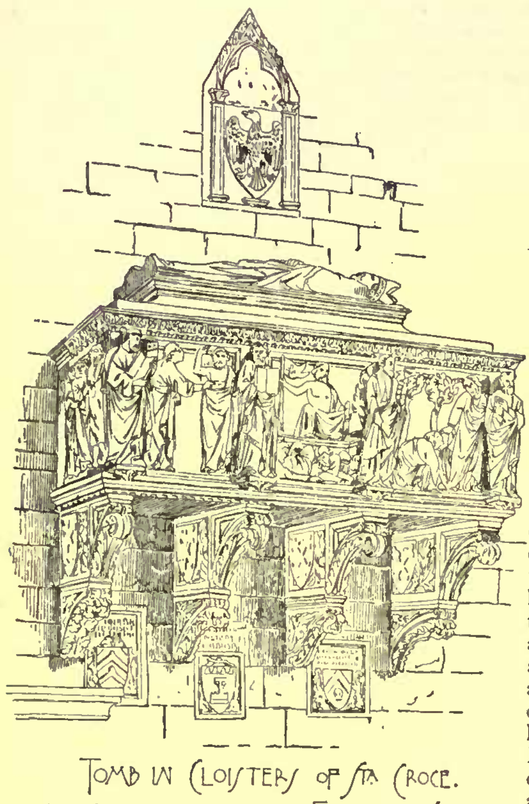
punish lock-outs as it can boycotts, for it is said that the locked-out clothing-cutters in New York have resolved to appeal for relief to the courts. The question of the legality of lock-outs is a much more complicated and more interesting one than the other, and we believe that a single ruling one way or the other would not be conclusive: each case would have to be tried on its merits without much reference to leading cases. With a single firm which for one motive or another saw fit to lock out its employés, we do not believe the law would ever meddle; but in cases where a number of firms have allied themselves for the sake of protecting their interests, it will be a matter of evidence whether the charge of conspiracy against labor could be sustained. If it can be shown that the interest of each member of the coalition would suffer in the same degree if the lock-out were not declared, the court would probably hold that no wrong had been done; but if it could be shown that only one member would suffer and that the other members joined in the lock-out only under the constraint of the conditions of alliance, then we do not see how a court holding that boycotting was illegal could do less than hold that this special lock-out was a conspiracy against the well being of the employés thrown out of work, and as such illegal.

WE are not at all opposed to the organization of labor unless there is too much of it, and unless the organizations effected for one purpose find it possible, and therefore are tempted to enter on coercive measures for the sake of unfair and unlawful aggrandisement of members or classes. We believe that until labor-unions have discovered that beyond certain limits the great unorganized public will not allow them to extend their control of every-day and common-place affairs there will be many conflicts with the law, which, though the final result cannot be doubtful, cannot but bring ruin on many men and many towns. It is a more insidious enemy of Republican or Democratic ideas than the movements of the professed anarchists, because every fair-minded person concedes to any class of men the right to coöperate for mutual protection and improvement. But every day brings fresh instances of the pernicious effects of the mania for organization, and shows how fast the unorganized public is finding itself reduced to an abject condition of subservience to unknown and unknowable laws, rules, and regulations enacted by small bodies of men who seek to enforce compliance with them whenever necessary by declaring a boycott. A particularly atrocious case of this kind has just been brought to trial in Cincinnati, on a claim for civil damages in $5,000, by a father who, his child having died of scarlet fever, being himself with his wife confined by illness to the room in which the child lay dead, sent a message to an undertaker to come and take charge of the burial. As no attention was paid to his message he sent to another undertaker, and then to a third, receiving no attention or explanation from any one. At length he discovered there was in the city an undertaker's union which had adopted a rule that no member should serve an individual who was in debt to any of the members, and that there was one undertaker who pretended to have a claim against him for eighteen dollars. As more than twenty-four hours had elapsed, and, as may be supposed in view of the nature of the disease and the weather, the case was urgent, the unfortunate victim, though denying the validity of the claim, was obliged to pay it, and then brought suit against the union. We devoutly trust he may win. Another case of boycotting, which seems to show more than ever that only cowards engage in it, and only when the victim is supposed to be helpless, is that of a Maryland woman who, when her husband died, found that her only resource lay in certain undeveloped beds of limestone. She at once erected lime-kilns, and was so successful in her operations that she developed a large business, and by so doing excited the envy of all the lime-makers in the vicinity, who thereupon combined against her and employed every legal and illegal device to bring about her ruin. At length, last week they addressed a letter to their customers at Baltimore stating that if any one bought lime of Mrs. Schaeffer they could not obtain lime from the members of the combination. Fortunately their Baltimore correspondents were men, not truckling knaves, and they at once wrote to Mrs. Schaeffer that they would take the entire product of her kilns. If the boycott could be faced in this manly fashion whenever it is attempted, this most un-American exotic could not long survive.

IN another part of this issue are given certain facts regarding the use of the automatic sprinkler in mills and other buildings. The system is one of the most important agencies in saving wealth to the world that has been discovered in recent years — but it has its imperfections and it occasionally happens that a building though thoroughly equipped with sprinklers will burn, as did the Glen Woollen Mill at Hampden, Mass., a week or two ago. On the same night, in another Massachusetts town, Pittsfield, occurred a very unusual kind of accident which resulted from the presence of the automatic sprinklers. Every one now knows that the essence of the system is a fusible metal which holds the valve of each sprinkler firmly to its seat until the general temperature of the room or of the part near a sprinkler has been raised to such a degree that the solder is melted and the water-spray comes into operation. The degree of heat required to fuse the metal depends on the composition employed. At Pittsfield a peculiarly sensitive alloy was used, and it appears that the heat accumulated in an upper room during one of our recent hot Sundays was sufficient to melt it and allow one or more sprinklers to come into play and have things all their own way until Monday morning, when it was found that a water-damage of more than two thousand dollars had been inflicted on the contents of the building.

SOME time ago, the manufacturers of lamp-black in the Black Forest, like other manufacturers of lamp-black everywhere, were troubled by frequent explosions, which occasionally proved fatal. No cause for them appeared, and an expert, Herr Engler, was commissioned to make a careful investigation of the matter. At that time it was thought by many that a cloud of any combustible particles, suspended in the air, could be made to explode. Air charged with flour in flour-mills, or with coal-dust in mines, often explodes with terrible effect, and there seemed to be reason to suppose that the fine dust of lamp-black, which is usually so disposed to chemical combination as to catch fire immediately on being touched with nitric acid, and often takes fire spontaneously from contact with the air, might behave like flour under similar circumstances. The apparatus employed in the investigation was very simple, consisting mainly of a long box, furnished with a gas-jet at one end and a tunnel at the other, with a wheel to distribute the dust into a cloud, filling the box. Many trials were made with the lamp-black, both crude and refined, so as to take away from the dust its tendency to adhere into flakes, but in no case was any explosion obtained, nor could the dust be even burned, except so far as the particles came actually into the influence of the flame. With flour, on the other hand, a tolerably lively deflagration was always produced, and with naphthaline or rosin-dust a sure explosion followed. Powdered sulphur burned quickly throughout the box, but neither charcoal-dust nor lamp-black suffered any change. Reflecting that the air in lamp-black furnaces is warm, Herr Engler repeated his experiments, both with this and with charcoal-dust, mingling them with air heated to a temperature of five hundred degrees Fahrenheit, but the result was precisely the same. The dust of soft coal is known to be very explosive, and Herr Engler concluded, as others have done, that unless the dust in the air is of such character as to give, by heating, combustible gases, it will not form with air an explosive mixture. Soft coal, when heated, gives off hydrocarbon gases, and flour produces similar ones, joined to others, and both these, when mixed in dust with air, explodes, while charcoal and soot, which produce no gas by heating, will not propagate flame when in that condition. Another series of experiments was then made, to see whether, if inflammable gas were supplied to the air from some other source, the charcoal and lamp-black dust would explode. The apparatus was connected with the city-service gas-pipes, and different proportions of ordinary carburetted hydrogen were admitted to mix with the air in the box. If eight per cent or more of gas were allowed previously to mix with the air, and dust of charcoal or lamp-black were then scattered through it, an explosion took place on applying a flame. If from three and one-half to eight per cent of gas were present, there was no explosion, but the box was filled with flame. If only two and four-tenths per cent of gas were present, there was no burning of the dust. As lamp-black furnaces very often contain hydro-carbon vapors, from the imperfect burning of the oil or other material used to make the lamp-black, the explosion of the dust in them, in presence of this gas, was easily explained, and the method of avoiding such explosions, by improving the combustion indicated.

MÜNTZ'S[1] RAPHAEL.—I.



TOMB IN CLOISTERS OF STA CROCE. FLORENCE. ITALY.
AFTER SKETCH BY H.W. INSDALE. AA SKETCH BOOK. LONDON.

MORE than once in these columns I have exploited the researches and verdicts of the distinguished author of the "*Life of Raphael*"—distinguished even among French writers on art. Whose touch so delicate, so *spirituel*, so thoroughly artistic as theirs—unless it be their congeners, the Italians? They enliven the dullest themes; they help the layman through the mazes of æsthetic lore, and over the arid stretches of æsthetic polemics, as only Frenchmen can. Comparatively our own efforts seem ponderous, verbose, and dry as dust. Our arguments fall like the blows of a sledge-hammer, while theirs penetrate like a rapier-thrust. One is inclined to smile ever and anon at their ingenuity, that suggests some fanciful hypothesis — more brilliant than discriminating — though this is a fault common, perhaps, to the profession in all lands; yet even were it peculiar to the Latin races, it is the more graciously condoned, as it is charmingly committed. Taking into consideration the now bulky mass of Raphaelesque literature, one would suppose that the last word had been uttered concerning the divine painter of Urbino; but the work before us confutes any such supposition. Fresh discoveries, new methods, broader sympathies have added—and will doubtless continue to add — a great many last words. Everything that throws additional light on the life, work and character of a genius so exalted, will always be eagerly scanned and religiously recorded. Apart from the mere gratification of our literary or æsthetic curiosity, nothing can be more edifying than the spectacle of a consummate artist's evolution, especially at the present moment, when, emancipated from the dogmas of a hieratic or academic past, we are ready to profit by whatever promises the most beneficial results. The modern reproductive processes would in themselves justify another "*Life of Raphael*," even were the text to remain unmodified. What perplexity, obscurity, and loss of precious moments does not an opportune illustration save? How much more facile and pleasurable is the digestion of M. Müntz's richly illustrated pages than the pictureless volumes of Passavant. We may quarrel with some of the reproductions, especially those from engravings and copies of the finished pictures, as being inadequate to a true representation of expression; but even these are perfectly satisfactory as to composition, and enable us easily to follow the printed description; while it is needless to say that the fac-simile reproductions of Raphael's studies and sketches are almost equal, for the purposes of investigation, to the originals themselves.

The opening pages of M. Müntz's book are devoted to a picturesque description of Urbino and its environs, as well as to a spirited estimate of the chivalric *condottiere*, Frederic of Montefeltro, protector of the arts and letters, and father of his people. Their "*Dio ti mantenga, Signore!*" [God preserve thee, Signor] was as genuine as it was spontaneous. His taste was both personal and catholic, for exclusiveness was not a characteristic of this golden age of the Renaissance. His eclecticism even prompted him to send for the Flemish painter, Justus of Ghent, and to the *chefs-d'œuvre* of contemporary art were added the priceless works of antiquity. Frederic died in 1482, the year before the birth of Raphael, and was succeeded by his son, Guidobaldo, who, from his earliest youth, evinced a marvellous disposition for study—a disposition that his subsequent patronage of art and literature did not belie. Like his father, he was brave and cultivated. Moreover, his gracious consort, the beautiful Elizabeth Gonzaga, ably seconded him in all his enterprises. In such an environment, so propitious for the development of the most generous sentiments, the most brilliant qualities, Raphael was born.

"Assuredly," continues M. Müntz, "had the painter of the Stanze and Loggia been a Florentine, he would have participated earlier in a more intense artistic movement; he would have acquired more rapidly a full knowledge of the secrets of his profession, as well as a more intimate acquaintance with classical antiquity, that fruitful source of progress. But it seems to us, taking all things into consideration, that he had but little to regret, as far as intellectual development was concerned, in being born at Urbino. It was important, in fact, that he should be able to commune with himself during his childhood in a calmer sphere, and to enjoy the beauties of nature while familiarizing himself with the rudiments of drawing. Urbino —and that was the essential thing — offered him very fair examples, thoroughly imbued with the spirit of the Renaissance. Subsequently it would be easy to fecundate these germs, and, in due time, to impart to his genius a bolder flight."

It is of interest to note that Raphael's paternal grandfather and great-grandfather, as well as his maternal grandfather, were tradesmen, or rather modest shop-keepers. The second kept a "variety store" in the environs, till he was driven into town by the savage Sigismund Malatesta, tyrant of Rimini. Raphael's mother, Magia Ciarla, brought to the *ménage* a dowry of one hundred and fifty florins (almost a thousand dollars), a very respectable sum, when it is considered that Lorenzo the Magnificent gave his daughters but two thousand florins. Raphael's father, Giovanni Santi, was a typical provincial master of the fifteenth century. "He is not yet the emancipated artist, by force of talent the equal of the warrior, the diplomatist, the prelate or the *littérateur*, but the modest and frugal *bourgeois*, ready to accept every commission, provided it be well recompensed, full of consideration for his relatives or neighbors belonging to other corporations — the draper, the tailor, the druggist. To judge him only by his daily occupations, one would be tempted to take him for an artisan rather than an artist. In fact he is seen by turns painting a banner for a procession, illuminating an escutcheon, gilding a wooden candelabrum; it may be that he has occasionally colored doors or windows. But be not deceived; this workman, apparently so humble, has travelled; he has studied the works of the most celebrated masters, he is thoroughly conversant with the secrets of his craft, he neglects nothing to acquaint himself with the latest methods. It would be an error to believe that his horizon is limited to painting; he has observed and read. He is familiar with the names of the humanists, Francesco Filelfo, Campano, Porcellio, Cristoforo Landino. More than that, he can handle the pen, and the composition of a poem has no terrors for him. The '*Chronique rimée d' Urbin*,' which Giovanni Santi composed in honor of the dynasty of the Montefeltro, still exists to prove, we do not say with how much talent, but at least with how much facility the artist could express himself in verse."

When his father died, Raphael (born March 28, 1483) was but twelve years old. The methods of instruction obtaining at this epoch were not identical with those of the preceding century as described by Cennini, though not dissimilar. Life was now faster, more intense, less contemplative; though doubtless mediævalism lingered in Urbino and the provinces long after it was extinct at Florence and in the great cities. Many of the artists of this period were extremely precocious. Mantegna, for instance, was only seventeen when he painted the "Virgin of S. Sophia of Padua." Michael Angelo, born in 1475, entered the atelier of Ghirlandajo in 1488, and sculptured, in 1489, the famous mask that attracted the attention of Lorenzo the Magnificent. Fra Bartolommeo, also born in 1475, was admitted to the atelier of Cosimo Rosselli in 1485. He was only about fifteen when he began to work for himself. Perugino commenced his apprenticeship at the age of nine. Andrea del Sarto was still younger when he was placed with a goldsmith, being only seven. Allowing about four years for apprenticeship, and as many more for collaboration, strictly speaking, at the age of sixteen an artist could have terminated his severe but rapid studies. And as I have frequently reminded my readers, there is no system of artistic training in any wise comparable to that of apprenticeship and collaboration, —precept and practice—under the eye of a sympathetic and paternal master. It is fair to assume that Raphael followed the curriculum then in vogue, and that before his father's death he acquired from him the rudiments, at least, of his profession. But let those who develop late take heart from Raphael's example; for, in the words of M. Müntz, "his development was slow and laborious, in direct opposition to Michael Angelo's, whose progress from the very first was proclaimed miraculous. And we would not have it otherwise. It gives us pleasure to discover traces of efforts, of hesitations, and—why conceal it?—of errors quite human, there, where for so long a time nothing had been seen except an uninterrupted series of triumphs savoring of the marvellous."

Taking the tastes of Giovanni Santi into consideration, it is more than probable that, besides a very careful artistic education, the son received some solid literary instruction. The Italian artists of the fifteenth century were less ignorant than is generally supposed. Compared with the autographs of the mediæval and renaissance artists published by Milanesi and Pini (Florence, 1873), that of Raphael is conspicuous for its correctness and elegance; it is very evident that he could manipulate the pen as well as the crayon. Besides these elementary acquirements, he doubtless learned the rudiments of Latin. The study of this language, which the Italians

[1] *Raphael, sa vie, son œuvre, et son temps*," par Eugène Müntz, Paris. Librarie Hachette & Cie., 1886.

still cultivate, and which they know almost as well as the vernacular, was not confined, in the fifteenth century, to a narrow set of professional scholars. In Frederic's time the whole court, including the prince's second wife, Battista Sforza, carried on their memorable discussions in Latin. Mantegna unconsciously mixed it up with his Italian. Benedetto da Majano kept a number of Latin books in his library, and Leonardo da Vinci constantly cited works written in the same language. Perugino, who was noted for his ignorance, would have deemed himself dishonored had he not signed and dated his pictures in Latin, and, wonderful to relate, all his inscriptions are correct. M. Müntz thinks that it may be assumed — till proved to the contrary — that he learned as much of this language as the majority of his *confrères*, and that it was not long ere he had read the Old and New Testament, Dante's "*Divine Comedy;*" perhaps, too, the "*Golden Legend*," and subsequently the "*Morgante Maggiore*" of Pulci. Still later he took from Virgil's "*Æneid*," the "*Metamorphoses*" of Apuleius, and Poliziano's "*Stanze della Giostra*," the subjects for important compositions.

Deprived, by his father's death, of a guide and protector, Raphael was compelled to witness some sharp discussions on family interests. But however bad their influence may have been, he was at least spared the spectacle of penury. His patrimony certainly was not sufficient to enable him to play the amateur; it was necessary that he should work to gain a competency. Yet he certainly must have appreciated the advantages that his situation, modest though it was, gave him over many of his *confrères*. It was a great blessing to be able to pursue his studies in peace without worrying about the morrow, as would soon be exemplified to him by the conduct of his future master. Perugino — if we may trust Vasari — was in such want that he slept for months on a wooden chest. He braved cold, hunger, fatigue, and even shame, to become rich. None more than he sacrificed the dignity of art to the love of gold. "So true it is that poverty often abases the noblest talents, if it does not break the energy and degrade the character."

The old theory that Raphael entered Perugino's atelier in 1495 has, owing to the researches of M. Springer, been abandoned, and for the best of reasons — because Perugino was not in Perugia for any length of time, from 1493 to 1499. Towards the close of the latter year he returned home to execute the famous frescoes of the Sala del Cambio, and in all probability Raphael then became his disciple. It is supposed that Raphael studied in the meantime at Urbino, under his fellow-townsman, Timoteo Viti, pupil of Francia. A warm and lifelong friendship was there formed between the two. In his more splendid days the great painter was not oblivious of his early companion. The indirect influence of the architecture and paintings in and about Urbino on the young student must have been considerable. His drawings from the philosophers by Justus of Ghent in the library of the Palace are still extant. The beautiful palace itself, so pure and harmonious in line, the work of Luciano da Laurana, must certainly have left its trace on his receptive mind. It is pretty certain, too, that he studied, among others, the paintings by Melozzo da Forli, Fra Carnevale, Piero della Francesca, Signorelli's banner, painted in 1494 for the church of Santo Spirito, and finally the prints of Mantegna and Martin Schoen.

Almost every traveller will recall the inspiring landscape of Perugia. Perched on a lofty summit, its slopes thickly dotted with villas, vines, and misty olives, it commands a mighty view of fertile plain, and waves of rugged mountain forms, undulating like the sea. Such stimulating vistas must have greatly moved the impressionable Raphael, for do we not constantly find souvenirs of these glorious views in his earlier works? While on the one hand the aristocracy was ferocious to a degree, on the other the people were gentle, humble, and warmly attached to the beliefs of a by-gone age. This was not the land for strong emotions, but rather for religious meditation. The Umbrian type suggests the madonnas of its school, that charm rather by beauty of expression than by regularity of feature. Though not without its university, and its distinguished men of letters, Perugia had but little to offer in the way of intellectual resources as compared with the brilliant court of Urbino. Of such a country and such a people Perugino, pictorially speaking, was the spokesman. Notwithstanding his long sojourn at Rome and Florence he always remained profoundly attached to the Umbrian tradition. Though he introduced new elements, and carried to a perfection hitherto unknown the science of color and perspective, he always remained the painter of sweet meditation, and divine ecstacy, the painter *par excellence* of saints and madonnas. Whether or not he was a sceptic, as Vasari asserts, whether or not a belief in the immortality of the soul could ever penetrate his train of "porphyry," it must be averred that no one ever rendered the pathetic, tender, and almost feminine religious sentiment more admirably. Such an art tallied exactly with the ideals of his compatriots, and they wanted no other. As in Byzantine art, certain types were consecrated, and any deviation would have been unacceptable, which, in a measure, accounts for the master's uniformity — though not entirely. Here we have an example of a popular art that in the main was good. Humble artisans deemed themselves well recompensed for a life of toil and privations could they but endow their church with a beautiful picture — a Perugino, for instance. To a young and generous nature such examples were very inspiring, and it was fortunate that Raphael could imbrue himself in the vital sources of popular sympathy. The works that he produced later in Rome, amid a burst of applause, are certainly more learned and beautiful: but are they as touching?

Perugino was in the hey-day of his career when he was commissioned to decorate the Cambio. It was then that Raphael entered his atelier. The conditions of apprenticeship and companionship, or collaboration, towards the close of the fifteenth century, are tolerably well known. The contract of apprenticeship generally imposed on the parents a considerable expense. But the master on his part agreed to lodge, nourish, and instruct the pupil, as well as to replace his worn-out clothes. The conditions of companionship were naturally more favorable for *débutants*. Instead of paying the master (after, perhaps, a year's probation without pay), they were remunerated by him according to their deserts. It is probable that Raphael, who was at that time about seventeen years old, sought Perugino for advice and direction rather than for elementary instruction, and entered his atelier as a collaborator, or *garzone*, not as a pupil, or *discepolo*. At all events, the best authorities admit the collaboration of Raphael on the frescos of the Cambio.

According to Vasari, Perugino was quickly fascinated by Raphael's skill, seriousness, and amiability, and the issue justified his predilection. On the other hand the pupil requited the master's affection. Thenceforth the cordiality of their relations never changed. Among other well-known painters working at this time in Perugia were Fiorenzo and Pinturicchio, Giannicola Manni, author of the frescoes in the chapel next to the Sala del Cambio, and Andrea Luigi, surnamed Ingegno, a celebrated artist in his day, but whose rôle has not yet been clearly defined. Perugino had gathered about him a goodly number of pupils, on some of whom Raphael cast a potent spell; on Domenico Alfani, of Perugia, for example, on Girolamo Genga and Giovanni di Pietro, surnamed Lo Spagna, who were later enrolled among his collaborators at Rome.

It is not always an easy matter to catalogue correctly the pictures that issued from Perugino's atelier between the years 1499–1502 (and the best authorities differ); for Raphael assimilated all that he could of Perugino's style, even his mannerisms. But there is much less chance of confounding their drawings, for Perugino's "are infinitely more archaic" and full of carelessness. Raphael's, on the contrary, are scrupulously exact — an exactness he maintained to the very last. "When Raphael left his master, in 1502, he had learned all that the old Umbrian could teach him. Oil and fresco painting had no secrets for him. Later, certainly, his brush acquired more freedom and power, but it lost, also, some of its qualities; the general tone was less amber-like, less warm and luminous than in his first attempts, imperfect in so many respects. If from the point of view of color Perugino exercised on his pupil a most salutary influence, from the point of view of drawing his action was far less fruitful." Vasari (who has his likes and his dislikes) says that it was only with the greatest efforts he rid himself of Perugino's dry and poor style of drawing, and that "he learned to render the beauty of the nude and the secrets of foreshortening by studying the cartoon painted by Michael Angelo for the Sala del Consiglio, at Florence."

After referring to the influence exercised on the young painter by Pinturicchio and the neighboring works of Signorelli (1441–1523) as evinced by the famous sketch-book of Venice, M. Müntz discusses at length the authorship of these drawings. Though a majority of the savants attribute them to Raphael, there is a strong dissenting minority, including the ingenious Morelli (who assigns them to Pinturicchio). It would be impossible here to recapitulate the *pros* and *cons;* merely let it suffice me to say that M. Müntz makes a very strong and (as well as one can judge without making personal investigations) apparently convincing argument in favor of Raphael's authorship. The young artist was nineteen years old when he began to work on his own account. Umbria had become to him a second fatherland. Thanks to the liberality and sympathy of its people — and warmly recommended, doubtless, by the overworked Perugino — he now executed several of those pictures, modest in size, as was natural for a beginner, that have since been so justly admired, such as the "Madonna Solly," of Berlin, the "Madonna Staffa Conestabile," of St. Petersburg, etc. These commissions were necessary to save him from the isolation, the uncertainties, and the many struggles to which his master's departure exposed him. The status of an artist at the close of the fifteenth century is too interesting and suggestive to be ignored. Modern investigation has drawn aside the old veil of romance and discovered Raphael living the life of his master and his *confrères* — a life essentially humble and *bourgeois*. It cannot be too often reiterated that the Renaissance but tardily sanctioned the emancipation of architect, painter, and sculptor. Till the commencement of the sixteenth century the most celebrated masters were constantly confounded with the artisans, or rather artists and artisans were one and the same. If they were treated with *hauteur* by their patrons, if interminable solicitations were necessary to obtain the smallest payments, it was in a measure due to the fact that they were unable to elevate their characters to the level of their talents. Yet it must be borne in mind that their endless complaints of poverty were in most cases but mere conventional phrases. It required the powerful genius of Bramante, Leonardo, Michael Angelo, and Raphael, as well as the ardent initiative of Julius II and Leo X to triumph over the old prejudices, and to make this disinherited class the peer of other representatives of thought. Shortly afterwards third-rate artists bedecked themselves with the titles of professor, chevalier, academician. But at the time of which we write in Umbria it was far different. The greatest of painters was simply "Master Raphael of Urbino" — and he painted *chefs-d'œuvre.*

Some of the stipulations that controlled the painting of a picture

loaded with gold embroidery, and chanting a hymn, and behind these was visible a cloud of smoke, surrounding a silver box, three or four feet square, over which was a silver canopy. As the chorus of priests advanced, there was a movement in the crowd of spectators, and the men took off their hats and held them in their hands; and when the silver censers appeared, accompanied by the ringing of little bells, nearly all those who had room to do so knelt upon the pavement until the Host had passed.

I could not be contented without running through a cross street to another point in the route of the procession, to witness again the solemn spectacle, which surpassed in impressiveness anything in the way of a peaceful political demonstration that I had ever seen. Indeed, I should hardly have believed it to be simply political if it had not been followed by the appearance of men selling popular Conservative newspapers, together with cheap lithograph portraits of the present Ministry, and of one or two pleasant, well-dressed individuals, who seemed to take great interest in conversing with the inhabitants of the small houses along the streets. I bought the Ministers' portraits, and a copy of the paper, which, so far as I could translate its Flemish, contained sentiments toward the Radicals and Socialists quite as uncharitable as those which the Socialist banners had expressed toward the present order of society, notwithstanding the superior Christianity which it so loudly claimed for its own party. Judging, however, from the appearance of the persons engaged in the two demonstrations, the Conservatives seemed to have a decided advantage in point of ability and intelligence. In these days one ought to be at liberty to criticise the appearance of a priest as a man, apart from his sacred office, and those who walked in the procession had, almost without exception, an air of refinement and force of character very different from that which one often sees in the Catholic clergy. If the rest of the priests in Belgium are like those of Ghent, there is nothing surprising in the great influence of the clerical party in the country, and it is, perhaps, not impossible that its leaders, through the exercise of the patience and forbearance which the Church inculcates, may be the first to attack with success the Socialistic windmill which so many political knights in Europe, some with soft words, and some with lances in rest, are trying to dissuade from brandishing its frightful arms.

THE ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

UPPER STORIES OF STORE, BEDFORD STREET, BOSTON, DESIGNED FOR F. L. AMES, ESQ., BY H. H. RICHARDSON, ARCHITECT.

[Gelatine print issued only with the Imperial and Gelatine editions.]

BUILDINGS DESIGNED BY THE LATE H. H. RICHARDSON, ARCHITECT.

ILLNESS cut short the task we had set ourselves of preparing a memorial issue of the *American Architect* which should contain such personal tributes to the late H. H. Richardson as his friends and fellow-architects desired to pay. When we were once more ready to go on with the work, we learned that his immediate friends desired to have prepared a more elaborate memorial biography, and as there seemed to be a feeling that what we proposed to do might be in some way prejudicial to the success of the more serious enterprise, we willingly abandoned our undertaking and placed at the disposal of the biographer selected, Mrs. Schuyler Van Rensselaer, the material already collected. As this could not apply to the sketches we had had prepared of the most important of Mr. Richardson's buildings they are published in this issue without comment or description.

As a matter of record we here append an imperfect list of the most important of Mr. Richardson's buildings:

Episcopal Church at West Medford, Mass.
Western Railway Office-Building, Springfield, Mass.
Church of the Unity, Springfield, Mass.
Agawam Bank Building, Springfield, Mass.
House for Hon. Wm. Dorsheimer, Buffalo, N. Y.
Insane Asylum, Buffalo, N. Y.
Exhibition Building, Cordova, Argentine Republic.
Brattle Street Church (now First Baptist), Boston, Mass.
High-School Building, Worcester, Mass.
Cheney Block, Hartford, Conn.
Trinity Church, Boston, Mass.
Phœnix Insurance Company's Building, Hartford, Conn.
Hampden County Court-house, Springfield, Mass.
House for Mr. B. W. Crowningshield, Boston, Mass.
North Congregational Church, Springfield, Mass.
House for Mr. W. Watts Sherman, Newport, R. I.
State Capitol, Albany, N. Y.
Winn Library, Woburn, Mass.
American Express Building, Chicago, Ill.

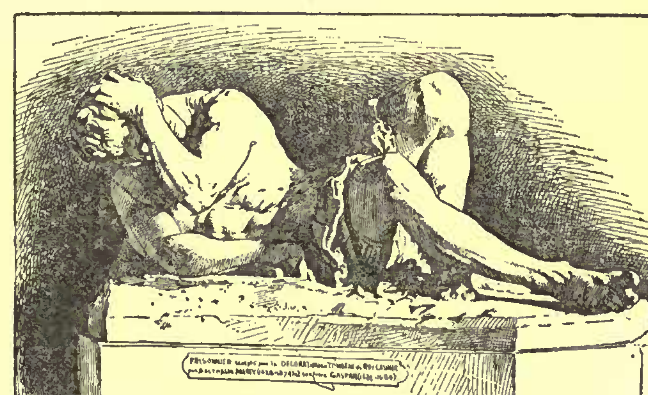
The above were executed while Mr. Richardson was in partnershi[p] with C. D. Gambrill.

Sever Hall, Harvard College, Cambridge, Mass.
City-Hall, Albany, N. Y.
House for Mr. F. L. Higginson, Boston, Mass.
Trinity Church Rectory, Boston, Mass.
Ames' Monument, Sherman, Wyoming Territory.
Store for Mr. F. L. Ames, Bedford Street, Boston, Mass.
Store for Mr. F. L. Ames, Washington Street, Boston, Mass.
Dairy Building, Boston & Albany R. R. Co., Boston, Mass.
Ames' Memorial Library, North Easton, Mass.
Ames' Memorial Town Hall, North Easton, Mass.
Railroad Station, North Easton, Mass.
Gate-Lodge for F. L. Ames, North Easton, Mass.
Station for Boston & Albany R. R. Co., Auburndale, Mass.
" " " " Chestnut Hill, Mass.
" " " " Palmer, Mass.
" " " " South Framingham, Mass.
" " " " Wellesley Hills, Mass.
" Connecticut River " Holyoke, Mass.
Austin Hall, Harvard College, Cambridge, Mass.
House for Mr. Grange Sard, Jr., Albany, N. Y.
Crane Memorial Library, Quincy, Mass.
House for Mr. N. L. Anderson, Washington, D. C.
Billings Library, Burlington, Vt.
House for Hon. John Hay, Washington, D. C.
House for Mr. Henry Adams, Washington, D. C.
Converse Memorial Library, Malden, Mass.
Newton Baptist Church, Newton, Mass.

The following buildings were under construction at the time of M[r.] Richardson's death:

Allegheny County Court-house and Jail, Pittsburgh, Pa.
Store for Mr. Marshall Field, Chicago, Ill.
Armory Building for Estate of J. J. Bagley, Detroit, Mich.
Cincinnati Chamber of Commerce, Cincinnati, O.
House for Mr. Franklin MacVeagh, Chicago, Ill.
" " J. J. Glessner, Chicago, Ill.
" " B. H. Warder, Washington, D. C.
" " R. T. Paine, Waltham, Mass.
" Prof. E. W. Gurney, Beverly, Mass.
" Dr. H. J. Bigelow, Oak Hill, Newton, Mass.
Station for B. & A. R. R. Co., Washington Street, Newton, Mass.
" " " Beacon Street, Newton, Mass.
" " " Boylston Street, Newton, Mass.

AMERICAN ARCHITECTURE FROM A FRENCH STAND POINT.



The Prisoner. From L'Art.

FOR a long time past I have been desirous of answering your i[n]vitation by sending you from France some notes which may [be] of interest to the numerous readers of the *American Architec[t]* but many occupations and a protracted tour into Italy have not [al]lowed me to put my project into execution at an earlier day. On t[he] other hand, when I come to the moment of writing I find mys[elf] much embarrassed.

Your estimable journal, which I have scanned with a lively inte[r]est, appears so completely *au courant* with everything that transpir[es] on our side of the Atlantic, that I ask myself, what subject is the[re] proper for me to touch upon? Not only the text of your journ[al] keeps its readers posted as to all which can be of interest to the[m] but also the sketches, which are very adroitly executed — I ha[ve] especially remarked those of Messrs. Blackall and Mead, pla[cing] before them, while preserving very perfectly their special physio[g]nomy, the edifices of our Old Europe. In very truth I can pro[fit] much more by the study of the *American Architect* than my Ame[r]ican *confrères* can benefit by any notes or reflections which I sh[all] have the leisure to address you.

In fact, your journal gives me complete information of all that [is] done in your country, and I find in the works of all kinds which a[re] carried on there subjects for observation which it would be diffic[ult] for me to make in our ancient classic soil. Your modern structur[es]

or fresco in those days seem very odd to us moderns. Generally, the price was settled in advance, the painter furnishing everything save gold and ultramarine, an exception that caused endless discussions. Payments were not infrequently made in kind. Sometimes the contract mentioned a supplementary fee, optional on the patron's part. Sometimes the artist, even the most celebrated, worked by the day or month; often he was boarded and lodged during the execution of the work. At other times no price was agreed upon in advance, but the completed work was appraised by an expert. Raphael preferred this system. His "Sibyls" in the Pace, by the way, were valued by Michael Angelo.

It would be an agreeable and profitable task, were it possible, to note every off-shoot from Raphael's budding genius; to observe the slowly-fading reminiscences of Giovanni Santi and Perugino; to vaunt the superiority of the pupil's to the master's "Sposalizio;" to signalize the important rôle played by landscape in his pictures; to watch him, now drawing from his comrades (in default of a female model), in their scant costumes of the epoch, for an ulterior figure of virgin or saint, and now from a skeleton; though quite capable of creating them from his imagination. As a combined result of temperament and education he arrived at the expression of feminine beauty long before he mastered the masculine qualities. He was apparently born to depict angels and madonnas. It is almost pathetic to witness his rendering of the famous "Three Graces," or rather his translation of it into Umbrian vernacular, during his sojourn at Siena, whither he was invited by Pinturicchio, to make sketches for the latter's frescoes in the cathedral library — but not to work on them. In 1504 he returned to his native Urbino, and joined the brilliant throng, so eloquently described by Passavant in his *"Life of Raphael,"* that frequented the court of Guidobaldo and Elizabeth.

FREDERIC CROWNINSHIELD.

[To be continued.]

AN EDITOR'S TRIP ABROAD.[1]—XII.

A SOCIALISTIC DEMONSTRATION AT GHENT.



Medallion on the Palace of the Legion of Honor, Paris. Clodion, Sc. From La Revue des Arts Decoratifs.

BELGIUM is, above all, the country of political freedom. We pride ourselves on being able to say anything we like, in public or in print, without fear of being called to account for it; but the habit of speaking and acting with some sort of moderation and decency is so ingrained in the Anglo-Saxon constitution that we rarely have occasion, except when a Herr Most rises up among us, to try whether we really possess that forbearance toward political lunatics and their ravings which the Belgians have so long and so conscientiously maintained. Whatever may be said of the wisdom of this attitude of universal toleration, it certainly helps to give flavor to the political contests of the country, which seem to rival our own in a picturesqueness which commends them greatly to the tourist in search of distractions.

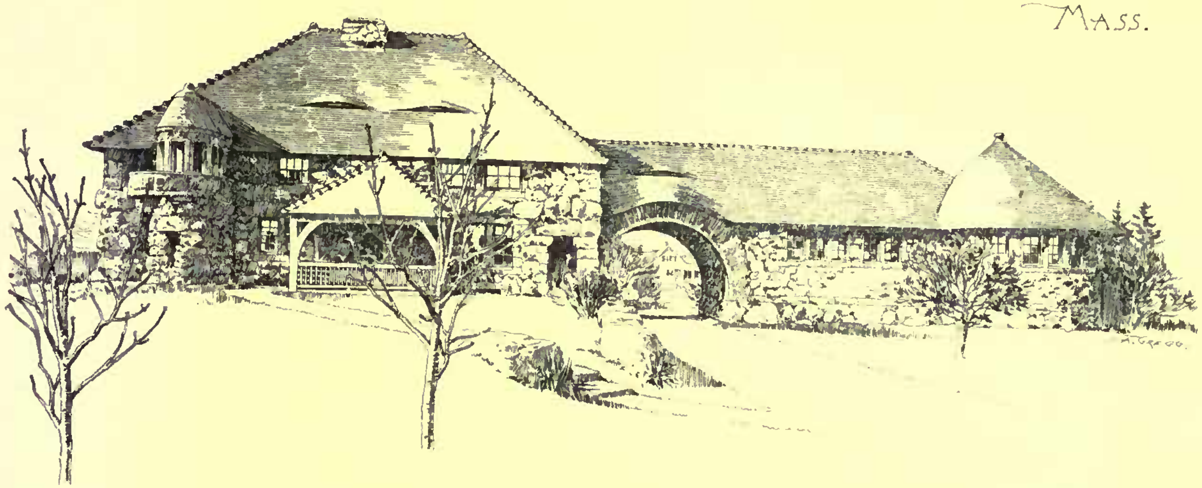
As we left the hotel this afternoon, on our way to visit the place where the noble statue of Jacob van Artevelde, to give him his real name, overlooks the scene of those turmoils which made him and the fierce citizens whom he ruled perhaps the most conspicuous figures in the history of their time, we were rather startled at coming upon a procession of men carrying red flags of all sizes, some surmounted by liberty-caps and others not, alternating with boards painted with inscriptions breathing sentiments quite unfavorable to property and privilege, and demanding, peremptorily, that the working-man should have his rights restored to him. Having just seen Amsterdam almost in a state of siege, after the bloody Socialist riot of the 26th of July, which occurred on the day before our arrival there, we were quite ready to share the apprehensions of the native spectators of this new demonstration, who had prepared their minds for the worst. However, the appearance of the participants in the procession was so amiable that we concluded that their anarchist animosities had not yet been excited, and that it would be safe to stay and watch them. The advance guard consisted of a platoon of small girls, probably volunteers, who danced and squealed like a chorus of infant bacchanalians, but the rest of the train consisted entirely of men, some in blouses, but more generally dressed in a decent Sunday costume, which contrasted rather curiously with their blood-red banners. After the first body, which contained a large number of men, and was probably a political club, came a number of regularly-organized working-men's societies, many, if not most of them, being for charitable purposes. These, like the rest, had been furnished with red flags and Phrygian caps; but their society names, which they carried on small banners, contradicted sufficiently the revolutionary emblems which floated beside them to take away much of their terror. The burden of the greater part of the placards carried in the procession was a demand for universal suffrage, the "remedy for the sufferings of working-men," as one of them called it, but, particularly toward the head of the line, there were the Flemish equivalents for some of the stock Socialistic formulas about the working-man's claim to all property, on the ground that he and steam had made it, and so on, with calls for the immediate abolition of privilege and class distinction.

[1] Continued from page 111, No. 558.

On the whole, it was not a very formidable affair, and the sober, honest faces of most of the working-men who composed the train took the terror quite out of their sanguinary emblems, so that we were not at all surprised to read in the papers the next morning that, although the troops were kept under arms all day, in readiness for immediate service, they were not called upon to shoot, or even to frighten anybody.

Not caring to be too near any possible disturbance, as soon as the red-flag procession had got well out of hearing in one direction, we took the other, and, after passing, as in duty bound, through the ancient region around the Marché du Vendredi, we turned easterly, and soon arrived at a place where an anti-Socialistic demonstration, quite as interesting as the one we had just seen, and a good deal more picturesque, was going on. The people of Belgium are, as a rule, very religiously inclined, and where, as in this instance, the priests consider it necessary to make a political exhibition, they have the means and influence for doing so very effectively. It is not wonderful that priests, with revolutions and communes in their minds, should look upon the political movement of working-men, especially when made under the shadow of red flags, as attacks upon the church, and they naturally give their counter-demonstration a strongly religious character. As we came toward the open spaces beyond the theatre, we saw certain streets decorated with numberless flags, and, guessing that this indicated a procession, we walked through a portion of the route, finding the houses everywhere nearly covered with flags, colored draperies, branches of evergreen, and paper flowers, while hundreds of banners hung across the streets. Most of the flags showed the red and yellow and black stripes of Belgium; but there were a good many in two stripes, of white and yellow only, while the banners had usually some sacred picture or symbol upon them, and in the first-story windows of nearly every house, and often in those of the other stories, also, were pictures or statuettes of some kind, with candles in front of them, ready to light. The two most richly-decorated streets, which were rather narrow, and seemed in perspective a mass of bright color, led to an open place, where a portable altar, consisting of a table with a sort of triptych reredos, so arranged as to fold up into a box, instead of quite flat, had been set up on a temporary platform, covered with carpet. The structure was richly carved and gilded, and the reredos, as it stood open, showed very effective paintings above the bouquets of natural flowers and the rows of candles which decorated the altar. This, as we learned from the conversation of the people about us, was for the ceremony of blessing the procession, which was expected to arrive before long. Not knowing how many minutes or hours they might have to wait in the crowd, the ladies concluded not to stay, and after conducting them to the hotel, I hurried back, just in time to find all the candles in the windows lighted, and the procession passing. Unlike the Socialist cortége, in which the vanguard of ragged girls was the only feminine element, that of the clerical-administration party was largely composed of women and girls, whose effective dress and sober demeanor added much to the impressiveness of the scene. The first body, composed mostly of policemen and young priests, who seemed to have the management of the affair, was followed by a band, and this by companies of children, probably from the church schools, dressed in different uniforms, and carrying banners. The smaller ones came first — the boys with faces newly washed and hair neatly brushed, and the girls with white dresses, and veils and wreaths on their heads — and then came the older ones, who wore similar costumes, but, in addition to their banners, many of which were beautifully embroidered in colors and gold, carried colored statues, in wood or composition, nearly life-size, usually representing what seemed to be some incident in the life of the saint whose intercession was invoked by the inscription on the banner which followed immediately after. As the procession advanced, the people in the streets strewed before it showers of bits of gilt and colored paper, and green rushes, which covered the pavement like a carpet, and gave the movement of the participants, and of the crowd of spectators, a noiselessness which was of itself a rather striking feature of the scene, and added materially to the solemnity which the managers evidently wished to give it, and which they increased by the skilful manner in which the order of the train was arranged. After the school-children, with their veils and wreaths, had passed by, came a troop of three or four hundred young women, dressed in black, with long veils, and carrying the instruments of the Passion, and after them several more religious societies of women, all dressed in black, with veils of white, or black, or purple, as the case might be, and carrying sacred images or emblems, with banners of increasing splendor. Then came corresponding societies of men, some, apparently, being bodies of seminary or college students, in uniform, while others were composed of laymen, without uniform, but carrying very rich banners, with crosses and other emblems, apparently of silver. Following these was a company of priests, carrying a banner, one or two figures of a saint whose name I could not see, and what seemed to be a huge silver reliquary, with small glazed openings in the sides, and something set up against the glass. Then came thirty or forty elderly and handsome men, in lay costumes, all carrying lighted lamps, apparently of silver, attached to poles, the upper portion of which was also covered with silver. The lamps were of various forms, but the workmanship of all was extremely rich. Next came another body of priests, in magnificent robes, carrying banners





GATE LODGE · NORTH EASTON ·
MASS.



NORTH CHURCH
SPRINGFIELD · MASS.
(Gambrill & Richardson)

Heliotype Printing Co Boston

AMERICAN ARCHITECT AND BUILDING NEWS, SEPT. 11, 1886.

H. H. RICHARDSON, ARCHITECT.





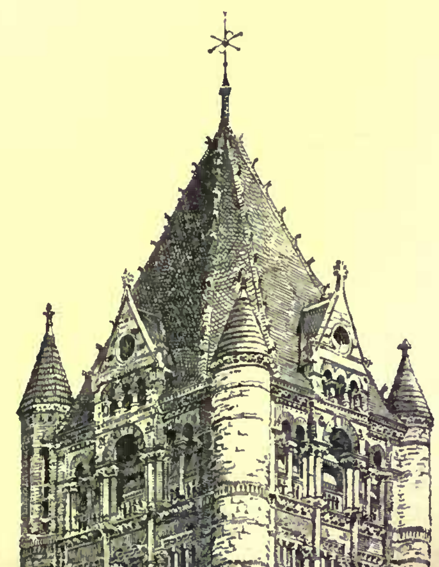
TRINITY · CHURCH · RECTORY ·



COURT HOUSE SPRINGFIELD MASS.

(Gambrill & Richardson)

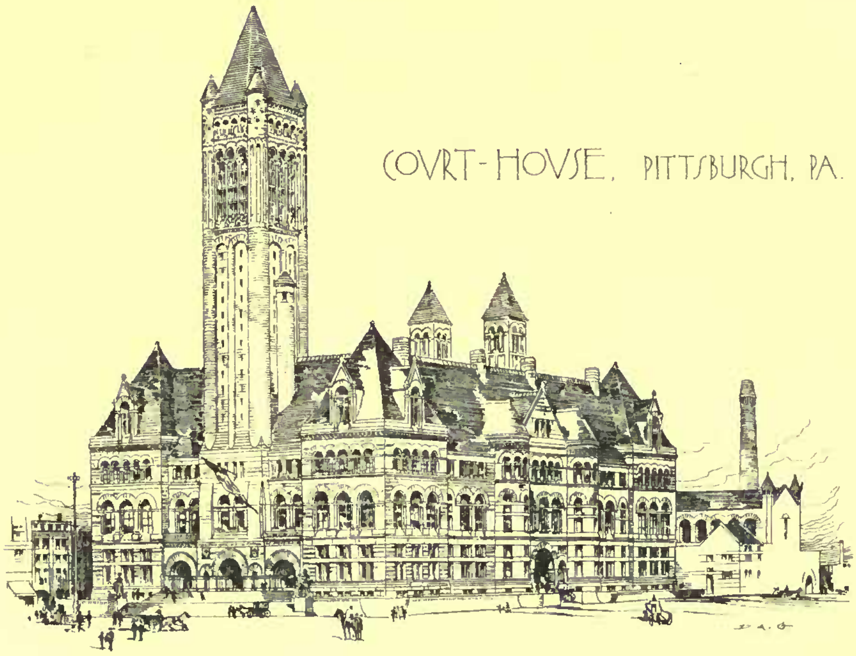
CHENEY BUILDING · HARTFORD



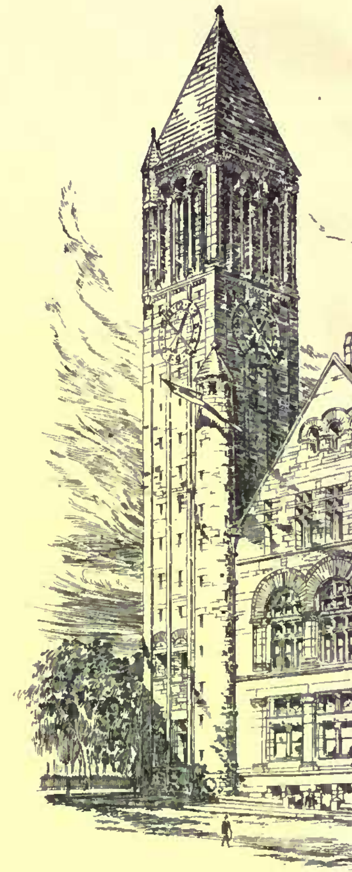
TRINITY · CHURCH BOSTON . MASS.

(Gambrill & Richardson.)

H. H. RICHARDSON, ARCHITECT.

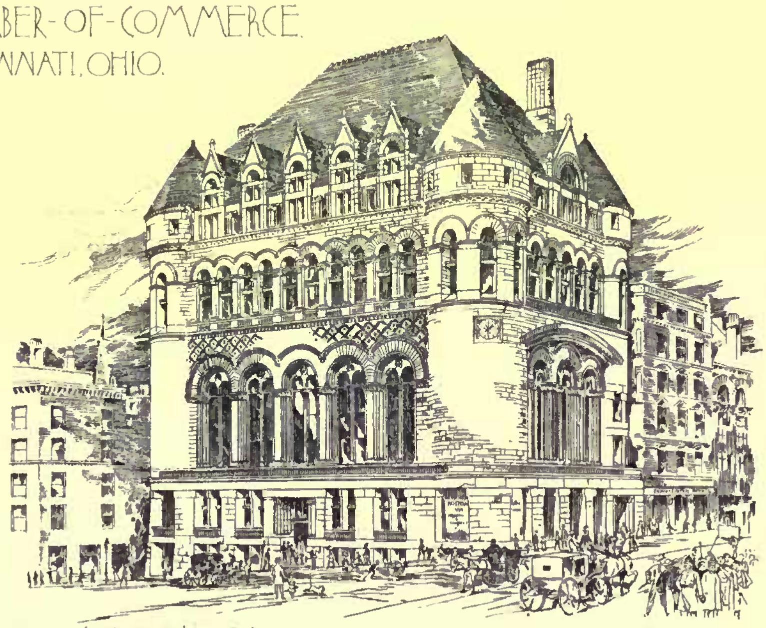


COURT-HOUSE, PITTSBURGH, PA.



CITY-HALL, ALBA

CHAMBER-OF-COMMERCE. CINCINNATI, OHIO.



(AFTER ARCHITECT'S DRAWING.)

LIBRARY, WOBURN, MASS.





TOWN-HALL,
NORTH EASTON, MASS.





"BRATTLE
SQ.RE" CHURCH,
BOSTON, MASS.



Heliotype Printing Co Boston

do not, I confess, give me complete satisfaction. I see in them the old European styles employed a little confusedly and often in a fashion which does not seem to me justifiable. As to the Classic orders which are derived from antiquity, they do not appear to be sufficiently understood as form nor studied as details. The exterior forms ought not to be merely an adornment, they ought to represent a function. There are æsthetic laws which are and will be of all times and of all countries, and to neglect them is to deprive one's self of the most essential elements of beauty. Besides, in order to appreciate with surety the value of a monument it is not sufficient to examine the façades, it is necessary to discover if they are the interpretation of the plan, — if they are in harmony with the character of the edifice.

Now at a distance it is very difficult to judge of all these things. Nevertheless, at the risk of finding myself mistaken, I think I may be allowed to say that the monumental character, such as we French architects understand it, that is to say, the harmony of forms with the *raison d'être* of the building is not the dominant preoccupation of American architects. I conceive that they especially seek varied aspects, even when these aspects are little in accord with the real function. From this, it is true, often results the unexpected, which, to be sure, has its own charm. Moreover, little troubled by tradition or the teachings of the schools your architects have sometimes an audacity which is astonishing, but which also may lay the groundwork of a more modern style by presenting new solutions for new problems. It is the right, perhaps, of a young nation like yours to cast in the old archaic moulds the elements of an architectural Renovation.

It may be that for the moment you are in the midst of a period of study, of experiment and attempts of which your monumental art gives witness. But your artistic enfranchisement will come perhaps from another side; for without delaying longer over these risky suppositions I prefer to tell you at once that if half the American buildings which aim at the monumental make me shiver, on the other hand, I am wholly seduced by your buildings of a domestic and private character. These constructions recommend themselves by a fancifulness, a picturesqueness which is truly charming. Here I find an art truly individual which does not find its equivalent with us. I recognize, nevertheless, that it proceeds in great measure from what is done to-day in England, in that new style, so much in fashion, called Queen Anne, without much reason I believe, and also from those rural constructions where a free employment of wood is permitted, which are inspired by the half-timber houses of the fifteenth, sixteenth and seventeenth centuries in England. But if in this you follow the English fashion, it is for the sake of appropriating for yourselves and making out of it something quite personal which has for us Europeans a very special flavor.

I do not disguise then my quick appreciation of the residences, houses, cottages, lodges, etc., which with you represent the habitation. One detects in them comfortable interiors, the family-life well protected and concealed: consequently there arises from these peaceful habitations, of a guise at once modest and coquettish, a perfume of the poetry of home-life which takes possession of one at once.

After this declaration of my sympathy, let my American *confrères* allow me to express some criticisms which are the result of a more sober examination. If the first impression is excellent, the second one tends to diminish it. One feels disposed little by little to discuss that which at the outset constituted the charm of this first sensation. One is seduced by these simple habitations, sheltered by vast roofs, of which the very eccentric plan seems to indicate from the outside rooms disposed so as to suit the habits of the family, and not for the sake of satisfying those vain rules of symmetry which are foreign to the needs of daily life. The absence, often affected, of every kind of consecrated architectural form and consequently the simple accentuation of the materials as decorative elements, rest the eye weary of false and pretentious decoration. In a word, it is the very simplicity of form, a certain *naiveté* in the construction and the picturesque aspect of the whole which constitutes the charm of these habitations. But from the affectation of these qualities, from a natural tendency to develop without limit the consequences of a good principle there result exaggerations which cannot be praised. Sometimes your country houses appear to be no more than lumbering peasants' houses buried under enormous roofs. The low ground floors seem plunged into the shade of porticos, verandas and projections of every kind which envelop the construction. The stories above necessarily find themselves inconveniently housed in the roofs which they penetrate in the form of dormers of every style and dimension. Besides, there is no relative proportion between the different parts of the whole: there is no common measure between these motives placed side by side and not bound together by a common origin. Inside, the irregularity of the arrangement seems to be more sought than absolutely necessary. The rooms interpenetrate one another: they jut out at every opportunity, making angles more *bizarre* than agreeable. All this without their seeming to be justified by real needs. The construction itself is exaggerated. The most rudimentary outlines are sought out, there are rustic walls with excessive rustication. The method of building no longer seems the logical and harmonious disposition of materials. In short, all art seems to be laid aside. It is no longer architecture. It is only construction more or less ably disposed to catch the eye by unexpected combinations, and not to charm by a fixed and continuous style.

Here is, it seems to me, a danger. We ought surely to admire the picturesque, but not always at the expense of the most elementary logic. Picturesqueness surely ought not to lead to the neglect of the essential laws of general harmony. People will be wearied as quickly of these exaggerations of the moment, as with a fashion without reason. Then the rectangular and cold constructions will have their revenge on the charming habitations which please us so much to-day.

In a style which is at once free and measured, I enjoy much the works of Mr. Hunt in the houses of Mr. Marquand and Mr. Vanderbilt. This elegant and distinguished architecture recalls to mind, it is true, certain fine specimens of our French Renaissance. Nevertheless, Mr. Hunt seems to have admirably accommodated them to the exigencies of life in your country.

But I am forgetting myself. I ought to tell you something of ourselves and of our works; and here I have allowed myself to enter on a criticism of architecture which the *American Architect* has placed under my eyes. My excuse must be found in the interest which I found in it; and I hope that American architects will pardon these criticisms, necessarily slightly formulated but well intentioned.

I will close by telling you something of our annual *Salon*, which closed on the thirtieth of last June; not that we must search there for a complete presentation of the efforts and tendencies of our contemporary architects. The exhibition of architecture is not like its neighbors, the exhibitions of painting and sculpture. There, doubtless, we find works from the greater number of our best painters and sculptors: few absent themselves. So, beside the great decorative works executed in our buildings, we see in the exhibitions of painting and sculpture the faithful expression of the artistic preoccupations of the moment. But it is not so with the exhibition of architecture. The architects who are the busiest, the most pushing, have little leisure to take part. They would with difficulty find the time to send thither, as is the usage to-day, numberless superficial metres of drawings to represent some of their executed works or some in course of execution. Besides, these drawings would necessarily be in great measure the work of numerous assistants. Moreover, the geometrical representations in use with us express very imperfectly the perspective effect and the *ensemble* of buildings which each one can appreciate at his leisure in execution. It is therefore on the public street that we make the greater part of our annual exhibition of architecture.

If I add that many other architects who have a great reputation acquired by real merit are not willing to risk it by sending drawings, long and difficult to make, and which demand to-day physical faculties and a skill with the pencil and brush which do not belong to every age, you will understand why our exhibition of architecture is limited almost exclusively to the following works: First, studies after the antique by our pensioners at Rome.

Second, drawings of our French monuments of the Middle Ages, of the Renaissance and of the succeeding epochs. Some of these drawings are destined for the collection of our historical monuments of which they prepare or propose the restoration. Others are the gratuitous work of certain young artists who aspire to take a place in the ranks of the valiant phalanx of architects who, under the direction of Government, have for their life-mission the saving of our old French monuments from oblivion and ruin.

Third, certain *projets* which have won prizes in the public competitions, and certain others which have won for their authors the diploma of architect, which is now granted by the *Ecolé des Beaux-Arts* to those of its students who have regularly followed its courses and fulfilled its requirements.

Fourth, finally, executed works or works in course of construction and a series of drawings of classes too numerous to mention.

The work of our pensioners at Rome have been specially represented this year by an important restoration of the Temple of Ceres at Eleusis, by M. Blavette. Relying on certain well-conducted excavations and on some lines of Strabo, in default of any description by Pausanias, who seems not to have dared to penetrate the mysteries of the temple of the great goddess, M. Blavette has reconstructed this venerated sanctuary with an ingenuity which does not lack an air of probability. At any rate, with great success as a designer, who does full justice to the work of Ictinus.

By the side of M. Blavette, M. Paulin exhibited an interior view of the restoration of the Baths of Caracalla. This is only a water-color, but so knowing in composition is it and so marvellous in execution that this *envoi* has been one of the most appreciated exhibits.

Not undertaking to give you a detailed description of these exhibits, the enumeration of which, in default of drawings to aid the description, could only be dry, I will confine myself to indicating only the most remarkable of the works. Among the studies of the Middle Ages and the Renaissance I will name the church at Gallardon, by Mr. Petit Grand, a church commendable for its choir and apse. Then by the same architect a restoration of the building known as the Machicoulis at Puy-en-Velay, a remarkable specimen of our military architecture of the twelfth century. M. Calinaud has sent drawings of the church at Marmans. M. Degeorges shows two able perspective views of the church at Vézelay, a nave of the end of the eleventh century, and a narthex of the twelfth century.

All American artists ought to know, at least from photographs, the Hotel Bourgtheroulde at Rouen, that ravishing specimen of the architecture of the fifteenth and commencement of the sixteenth century. MM. Lafou and Marcel have presented restorations of a most irreproachable vitality and absolute perfection of drawing. The patient, and conscientious work of these young artists has been one

of the successes of the exhibition. Among the *projets* submitted must be particularly mentioned the Palais de Justice at Bucharest, by M. Albert Ballu, son of the lamented architect of the Hôtel de Ville, at Paris, and the Church of the Trinity. The *projet* of M. Albert Ballu, vast and well-arranged, is not less remarkable for the dignity and calm of its architecture. A magnificent *salle des pas perdus* gives accent to the exterior and forms the principal motive of the main façade. This fine building will be shortly erected in the capital of Wallachia. Let me also mention the barracks of the *sapeurs-pompiers* lately built at Paris, by M. Roussi, which contains all the latest improvements effected in this useful branch of the service; also a plan, very practical and complete, for the *marie* for the Eighth Arrondissement of Paris, by M. Achille Hermant. The design for an observatory, by M. Peigney, must not be overlooked; nor the lunatic asylum built by M. Ricquier at Dury-les-Amiens; nor a very luxurious hotel, built by M. Cuvillier, on the Avenue Wagram, Paris; nor the skilful sketches and drawings by MM. Courtois, Suffit and Hourlier; nor yet a crowd of drawings of various kinds which bear witness to the inventive energy and the executive ability of our architects.

But I must close, under penalty of exhausting your indulgent readers by an enumeration which they cannot control. I, therefore, at this point close this sketchy communication, happy if, in spite of my criticisms upon some features of American architecture, if, in spite of my very summary notes on the Paris architectural exhibition, I have been able to interest for a few moments my *confrères* on the other side of the Atlantic. PAUL SEDILLE.

THE DANGER ARISING FROM ELECTRIC-LIGHT WIRES AND THE UNDERGROUND SYSTEM.[1]



THERE is a certain resemblance between the heroism of the soldier who rushes to the front in battle and the brave lad who combats the fire fiend — the one is a hero of war, the other no less a hero of peace. Yet both enter upon their duties with their lives in their hands. The soldier is well aware of the dangers he is to encounter, and he goes into the combat with as perfect preparation as the science of modern warfare permits. The dangers that surround the fireman are often unsuspected until too late for prevention, too late for cure. A piece of faulty architecture may, when unsuspected, overwhelm him; illegally concealed chemicals may poison the air which he is forced to breathe; unexpected explosions may bury him in ruin from whence escape is impossible. There is also another element of danger of comparatively recent birth which is rapidly on the increase, especially in the larger cities, and which being new, is but little understood. It is needless to say that I refer to the wires which convey the heavier forms of electrical currents for purposes of power and illumination. The great adaptability of these currents for such purposes have rendered them extremely popular, and, to use a common remark, they seem to have come to stay. This being the case, it is best that we know how much of danger there is in these innocent-looking wires, and how best to prevent the mischief they are capable of. The dangers in the case are two-fold — those which threaten life and those which threaten property. With the latter form of danger the firemen are interested collectively as a body; with the former as individuals, and it is but reasonable that the individual interest is by far the most important and nearest to him. To get at the matter understandingly it will not be necessary to go deeply into scientific definition, but this much will perhaps aid in its comprehension. Electricity is a force like heat or light, and possesses properties of quantity or pressure like steam, and may also be impeded in its flow or progress by want of carrying capacity, those substances known as good conductors, such as iron, copper, etc., offering the least resistance, and dry wood, porcelain, glass, etc., the greatest resistance. The greater the resistance of a given substance the less electricity will flow through it. Another fact will aid us in this investigation. If two routes are open to this current from the starting-point at the battery or generator back to the source, the electrical current will divide between the two routes and the better conductor will carry the lion's share. Thus, if two wires of the same size, one of copper and the other of iron, form the two routes, the copper will carry nearly seven-eighths of the current, and the iron one-eighth only. Now, if I have made this relative conductivity plain to you, it must be evident that a wire carrying one of these heavy currents may be made perfectly safe under all ordinary circumstances if the wire remains intact and there is but one route over which it can travel in its journey from its source and back to the starting-point. This may be accomplished by the use of various forms of insulation and insulation, remember, only means extremely poor conductors to keep the wire from forming contact with other wires, portions of buildings, roofs, awnings, rods, etc., through contacts with which a portion of the current may be deviated to the earth.

An electric circuit may be perfectly safe with one such contact to the earth, while only one such contact exists. But if when one such contact already exists on the line, a second one occurs, the elements of mischief are present which may result in disaster to property or serious injury if not death to an individual; and we have seen that the introduction of these grounds is like tapping a water-pipe with smaller tubes of a greater or less capacity. To illustrate this, suppose one of these wires conveying a heavy current is clear of contact save at a single point where it lies against an iron rod running to the earth. This will make no material difference to the machine or the lights, and it may remain unknown for months, unless sought for, until a second ground contact is made, when a more or less violent demonstration will develop. If circumstances are favorable the result may be the setting of a mysterious fire when the wire lies in contact with a wet board. As a rule wet kindling is not in demand. Electricity rather prefers it, because water-soaked wood is a better conductor than dry. Then again the second ground may be made by an individual, who, intentionally or otherwise, placed himself in contact with the wire, thus tapping it and drawing off part of its current. Remember the rule that the amount of current which such a contact will carry off is proportioned to its capacity for carrying, exactly like a water-pipe.

Naturally you will ask how much current will an average man conduct from the wire under these circumstances? There are so many elements entering into the calculation that the question is quite difficult of solution. Of a dozen men, taken at random, no two consecutively tested would show the same capacity for conveying a current of electricity. And very likely no two of the entire twelve. The same individual, under different circumstances, shows widely different capacity, and from one point to another on the same individual the measurements are never the same. A person measured when the contact-points, say the hands, are covered with perspiration, will carry more current than after washing them in water, although they are left as wet as before. Why? Because salt water is better as a conductor than fresh, and perspiration is salty. The amount of current then that it is safe to risk, it is difficult to specify. We can tell what the limit is which flows from a given source, say a battery, and a current from a dynamo may be compared with it. Many of you have seen more or less fun produced by what little power there is in a single cell of a battery arranged to astonish the hangers-on around an engine-house. You may have experimented, perhaps, accidently with a battery of say 250 or 300 cells, and been perfectly satisfied with one attempt. There is a wide difference between the two forms, the incandescent and the arc-light currents, but it is just as well to give both a wide berth. Any current which maintains an electric light is good enough to let alone, and intimacy with such forces is just as well left to the electrical fraternity. The amount of force generated by an electric-light dynamo, compared with a battery current, is as the strength of a giant compared with that of a babe. To make this a little more definite, the current generated by an electric-light dynamo is anywhere from 1,600 to 3,000 times that from a single jar of a battery, and the amount which the unfortunate who attempts to be intimate with such a current will, according to circumstances explained above, receive will amount from a mere tickle, or an urgent invitation to dance, up to an order for a first-class funeral. There are electric-light men who claim to have taken the entire current from a sixty-light machine and lived. Somehow I could never get one of these modest fellows to come out and give an exhibition. They always do this sort of thing when they are alone. As far as I am concerned I am perfectly willing they should have the fame if they want it. How all these dangers may be reasonably well-guarded against is a pertinent question. Chicago, as you are well aware, took

[1] A paper by Prof. J. P. Barrett, Superintendent of Fire-Alarms for Chicago, read at the Fourteenth Annual Convention of the National Association of Fire Engineers at Providence, R. I., August 24.



AN ALGERIAN DOORWAY.

steps in that direction over two years ago by the appointment of an inspector of electric lights, whose duty it is personally to examine and pass upon all plants within the city limits. He carefully considers the possibilities as well as the probabilities in the case, and orders such changes and dispositions as he deems necessary before the certificate is issued. In addition to this mechanical examination, electrical measurements are made by him to insure the absence or removal of grounds. In the majority of cases there is great danger of ground contacts where the wires of outside lamps are brought to the lamp. In order that this may be raised and lowered, a long loop of wire is allowed to swing in the wind, and may fold up in an awning or come in contact with an iron frame or other connection running to the ground. By an extremely simple and cheap contrivance this annoying and dangerous loop is now being done away with in Chicago, while the lamp is as readily raised and lowered as before. The surest and simplest remedy, the most perfect guard against danger to life and property from electric-light wires, as it seems to me, is inspection at the hands of some competent party, who should be clothed with authority to compel obedience to his just requirements. Again, the dangers from electric-light wires are materially lessened when these are placed beneath the ground, where contact with other wires, roofs and buildings is impossible, and where a loosened wire cannot drop across the street or sidewalk.

I must strongly urge upon all the great necessity as a precaution, a life-saving measure, of having some check put upon the unsafe methods of the electric-light people. The methods of accomplishing this are simple, and if an effort is made can be successfully carried out. The fire-departments and the insurance men are natural and friendly allies. If these but pull together for a general purpose they must succeed, and no stone should be left unturned until every electric-light plant in this country is subjected to proper inspection and control, and every wire, where possible, is put under ground.

I will conclude this paper with a few remarks as to why I consider underground wires the proper thing for cities generally, and for fire and police alarm service in particular, together with a short description of the system now existing in Chicago.

It is generally acknowledged that in a large, populous and wealthy city, where fire and police departments are considered necessary, that a simple, effective and reliable fire and police alarm system is indispensable. Such a system is in use in every large city in the country, and the electrical and mechanical parts of it have been so perfected by the work of earnest and scientific men that, as you know, a child can give an alarm that will at his choice summon either department to extinguish a conflagration or suppress a riot. But with the onward march of science, with the improvement in the equipment of the fire and police departments, with the improvement in the mechanism of electrical instruments, and the mastery that man has gained over electricity, the method of stringing wires for electrical use has not kept pace; in other words, the line-man has not kept up with the procession. In any large city in the land you can see huge poles towering aloft, carrying tons of iron wire; you can see these wires crossing and recrossing the streets, until it would seem as though you could not fire a bullet in the air without striking one. You can see them fastened to the same old cross-arms, uprights, brackets and insulators that we saw years ago — a menace to life and limb of the passers-by, a hindrance to the fire-department, and a general nuisance to everybody.

It has long been my conviction that the proper place for electric-wires in a large city is under the surface of the earth. Especially is this true of fire and police wires. In a system from which so much is expected, where a single broken wire may cause a delay in giving an alarm, involving a loss of thousands of dollars, it seems to me that we should have the wires in a place where wind, sleet and sulphurous gases cannot harm them. To be perfect, a fire-alarm system must be certain. It should be an absolute certainty that, when the hook in a fire-alarm box is pulled down, an alarm will be given to which the department will respond. We cannot have this certainty in our present system of aerial wires strung in the neighborhood of hundreds of other wires, subject to the destructive action of smoke and storm, liable to accident from countless causes; there is no reasonable certainty that, at the time a box is pulled, the line to which it is connected is not open or crossed in such a manner as to render it for the time being useless With a wire of suitable conductivity, well insulated and protected from mechanical injury, placed under ground, we will have this certainty, which the air line cannot give.

That is the way I feel about underground wires, and I am backing up the faith that is in me by planting those of the Chicago fire and police alarm telegraph as fast as I can get money to do it with. With me it is not a question for hair-splitting argument; it is a question of money, of first cost. Outside of that, everything is in favor of underground and against aerial wires, and that seems to be the general sentiment. All over the country we see or hear of preparation to get wires down. Although some of the telegraph companies are moving in that direction very reluctantly, still they are moving, and we may hope to see, at no distant day, all or nearly all of the poles and wires removed from the street and air, and when I tell you that up to July first, of this year, the city of Chicago and the various companies interested have taken down 608 poles and removed 917 miles of aerial wires, you will understand we have made a mighty stride in favor of the underground system.

In Chicago the agitation of underground wires commenced about the year 1875 or 1876, and in the year 1877 we laid our first underground wires. The work was performed under my supervision. We put down 840 feet of iron pipe, treated inside and out with a liberal dose of Stockholm tar, and through this we pulled two kerite wires. These proving satisfactory, the agitation was kept up, and a law was passed in 1881, to take effect in 1883, compelling all corporations and individuals owning or controlling wires within the corporate limits of the city to place them underground. In order to accomplish the requirements of the law, it was necessary to do away with the concessions which had been made by the authorities to the companies. It has been a work of time, perseverance and ingenuity, but it is now well under way, and we have underground systems of several kinds: iron pipes, wooden boxes filled, some with asphaltum, others with cement, etc.

Perhaps the most complete is that of the Sectional Underground Company, which is the Dorsett system, an asphalt concrete pipe made into one or more conduits or ducts, with man-holes and hand-holes through which cables are drawn in or removed. Outside of the city wires there is now controlled by the Sectional Underground Company a system consisting of about seventeen miles of conduit with 150 miles of wire, which includes all the electric-light wires; Western Union Telegraph Co., ten miles of conduit, with 200 miles of wire; Chicago Telephone Company, three miles of conduit, with 700 miles of wire; Bankers' and Merchants' Telegraph Campany, fifteen miles of conduit, with 400 miles of wire; Postal Telegraph Company, four and one-half miles of conduit, with 100 miles of wire; and the Baltimore & Ohio Telegraph Company, one-half mile of conduit, with fifty miles of wire.

Our municipal system, exclusive of the city electric-light wires, consists of sixty-three and one-half miles of single wires laid through 7931 feet of conduit built and owned by the city; twenty miles of single wires laid through four miles of conduit owned by the Sectional Company; ten miles of single wires placed under sidewalks in the central parts of the city; 1955 feet of wire in 840 feet of iron pipe, and about a mile and a half of cables under the river at Archer Avenue, Chicago Avenue, Division Street, Claybourne Place, and through the Washington and La Salle Street tunnels. The single wires are No. 13, copper-wire, B. & S. gauge 7-32, kerite insulation, wrapped with tape. The cables through the Washington and La Salle Street tunnels are of kerite, and the others gutta-percha insulation.

The conduit owned by the city is a nine-inch concrete pipe leading from the City-Hall to La Salle Street, and branching from there to the North Side, ending at Huron Street, to the south ending at Harrison Street, and to the West Side, ending at Clinton Street, with man-holes forty-four inches in diameter and five feet deep, for the purpose of testing, drawing in and out, etc. In the Huron Street branch we have twenty, in the Harrison Street twenty, and in the Clinton Street branch forty-two wires leading to lightning-arresters at each end, and from these points the air-lines diverge, covering the northern, southern and western districts of the city. In the man-holes we have testing boxes made air-tight with screw-head and rubber gasket. If we have trouble on one of these lines we can locate it between two man-holes, draw the faulty wire out, and put a good one in. The wires in the conduit were put in service in August, 1884, and have not given us any trouble since.

The wires placed in the Sectional Company's conduit and under sidewalks are wholly underground lines. They cover an area of nearly a square mile, and to them are connected all the municipal telegraph and telephone apparatus in that part of the city bounded by the river on the north and west, Van Buren Street on the south, and Lake Michigan on the east; in all forty-two street fire-alarm boxes, twenty-three police-alarm stations, seventy-nine private police and fire-alarm boxes, three fire-engine and hook-and-ladder companies, one marshal's residence, police patrol and fire-insurance patrol wagons, eight newspaper offices and the rooms of the Press Club. In this district is concentrated the greater portion of the wholesale, mercantile and banking interests of the city, and consequently here we have signal stations so located that the fire and police departments can be summoned from every hand.

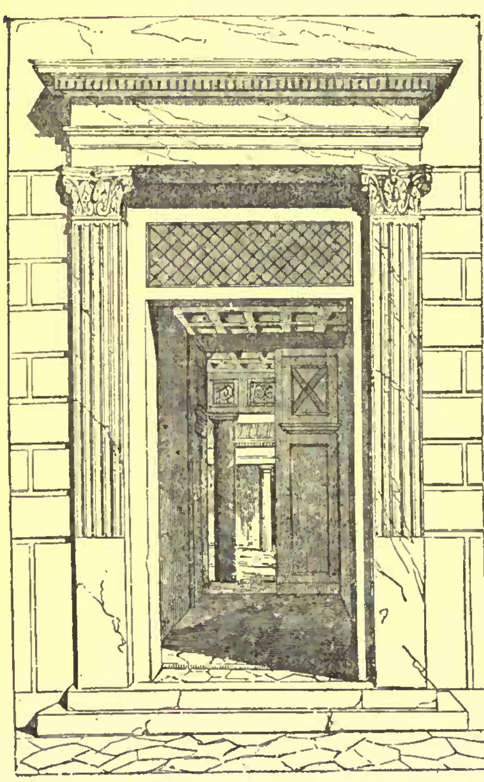
With these stations located in so many different places, how to reach them was probably as difficult a problem as the underground question can present. By using a duct in the Sectional Company's conduit, and utilizing the space underneath the sidewalks, between the area wall and the building line, we solved the problem in a manner highly satisfactory, at least to us, and by so doing were enabled to remove from the streets about ten miles of poles, and from the air twenty-five miles of wire, and have our wires where wind or sleet storms cannot harm them. The sidewalks are mostly of stone, and the space beneath them has been excavated and put to a variety of uses, such as barber-shops, boiler-rooms, Chinese laundries, tailor-shops, restaurants, saloons, coal-bins, etc. Although acting on the presumption that the city has a legal right to this space, the fact that the entrance to it lay through the store or office of the occupant, made it necessary to obtain his consent before placing our wires therein. When we explained that the ultimate results of so doing would be the removal of the unsightly masts that cumbered the streets, and the labyrinth of wires from the air, this consent was readily obtained.

The buildings are separated by partition walls, varying in thickness from six to thirty-six inches, and where used as coal-bins, etc., each building is divided by several partitions. These walls and partitions average about twenty to the block, and vary in kind from the

one-inch board to the three-foot stone wall. We cut through the walls, and, where the nature of the place required it, put in inch and inch-and-a-quarter iron pipe, using a short piece of larger diameter at the joints, instead of the regular coupling; this piece can be slipped back and forth, making it easy to get at the wires when necessary for the purpose of testing, etc. Where it was clear and dry, and mechanical protection unnecessary, we placed the insulated wires, without covering, well up out of the way, where they would not be likely to be interfered with. We crossed fourteen alleys, varying in width from fourteen to thirty-three feet, and mostly paved with granite blocks. As it was desirable to get through without digging up the paving, we drove pipes across, using for the purpose extra-thick inch-and-a-quarter iron pipe, with a steel point screwed in one end, and a drive-head on the other. When through, the head and point were taken out and the wire drawn in. We fastened our fire-alarm boxes to the lamp-posts, bringing the wires up through the posts and out to the box through a short piece of bent pipe. Where the fire and police boxes were located on the same corner, we set the fire-alarm box in the police-box facing out. The whole thing was the work of considerable difficulty, and required patience and perseverance, but we finished it in good shape, and I am happy to say that in that portion of Chicago known as the South Side, north of Van Buren Street, the city does not own an aerial line.

In conclusion I would state, as an instance of the desirability of underground wires, that those placed in the iron pipe in 1877 are giving as good service to-day as the day they were planted. We have never had occasion to touch them since; never had a ground cross or break on them, and for aught I can see they will continue to give the same good service when you and I have been called to our fathers, and have gone where I hope there are no fires—where fire-alarms and fire-department service will not be needed.

SEWAGE DISPOSAL IN BERLIN.[1]



FROM THE HOUSE OF PANSA, POMPEII.

THE system of sewerage in Berlin begun in 1870, has been in full operation for nine years, and now includes seven of the twelve districts into which the city has been divided for sewerage purposes.

The plan contemplates in each district a pumping station, where all the sewage is pumped to the irrigation-fields, some fifteen miles distant. Seven pumping-stations are established. The irrigation-fields are four in number, located to the north, north-west, south and south-east of the city. The four fields contain 14,666 acres of land.

Of the stations which I visited, it will be more interesting to describe the one which operates the drainage from the middle section of Berlin, which includes the Unter den Linden with its palaces, and a densely-populated district as well. One might suppose that its location would be in some out-of-the-way place, but we found it in a desirable portion of the city, not specially removed from other buildings, and only three minutes' walk from one of the finest railway stations in Europe. The buildings and grounds had a neat and orderly appearance.

In the yard I was first shown the large cistern into which is poured, and through which is strained the sewage of the whole district, including the flush and rain waters. The district has a population of 130,000, and the quantity of sewage pumped here is about 16,000 cubic metres daily. On Saturdays it is increased to 20,000 or 30,000.

It requires but an hour-and-a-half for all excrementa and other sewage to get from the place of deposit to this cistern, and so great is the quantity of water that by the time it is reached the excrementa are in thorough solution. The water dilutes and renders them inoffensive, and they are pumped away before putrefaction begins. It has been shown that in 500 cubic metres of the fluid there is but one cubic metre of solid matter; and in fact this fluidity of the sewage and its very rapid removal appear to be the two features which make this system successful.

The cistern has a capacity of 5,000 cubic metres. Its location is but a few yards distant from a busy street, and not more than twenty steps removed from the front entrance of the local manager's residence. It is covered with boards an inch apart, and upon stepping upon the platform we failed to notice any odor. No sickness has been caused by it either in the manager's residence or among the laborers. Occasionally it is necessary to flush it with water.

An attendant raised a few of the planks to give us a view of the contents. It appeared about half-fall of simply a muddy-looking fluid, a bucketful of which was hauled up and emptied back to show that it was liquid and without stench. The canal was visible through which the fluid was rapidly discharging into the cistern. It is elliptical, its longest and horizontal diameter measuring 3.40 metres, and its shortest or vertical diameter, 2.90. The fluid is not pumped directly from this cistern, but has to pass into a suction pit some thirty or forty feet nearer to the engines. The outflow channel has the same capacity as the one just mentioned, but its mouth is on a higher level and differs, too, in shape, being imperfectly elliptical, with the longest diameter vertical instead of horizontal.

Between the two openings, dividing the cistern into two equal parts, is an iron grating or strainer, the bars of which are perpendicular and two centimetres apart, and serve to catch paper, rags, etc., which are scraped out every day or two and burned under the boilers. The fluid passes into the suction pit just mentioned, where there are six cylinders operated by six engines. The pit was opened for our inspection, and though the fluid was in agitation there was no odor. Connected with the pit is an overflow for use when the rainfall is so great that the engines are unable to pump off as rapidly as the fluid collects.

We are now prepared to observe the other half of the system, viz.: its transmittal of the sewage through the pipes to the fields.

Taking the cars at the Anhalter Bahnhoff, a twenty minutes' ride brought us to the village of Lichtenfelde, a country place of ordinary appearance, as level as an Illinois prairie.

As we approached the fields on foot our noses were on the *qui vive* to detect the first polluted zephyr from the suspicious territory, but there was no zephyr of that kind. Presently we were on the borders of the fields, and made our way to a small collection of houses, inhabited by laborers and their families, to the number of about one hundred people. Finding the office, our permit insured us prompt and polite attention.

On going into the fields after noting the absence of odor, and the day was mild, our next surprise was the entire absence of machinery. The pumping force of the engines in Berlin is sufficient to throw the fluid to two central distributing points through channels measuring respectively one metre and seventy-five centimetres in diameter. From these two central points distributing pipes radiate in every direction for a certain distance, connecting with the open courses or ditches which extend through the fields. At the point of junction of the pipes with the ditches, valves are provided for regulating the flow.

There is no reservoir, the sewage being distributed as fast as it is received. But it sometimes happens that valves of a number of the distribution pipes are closed and at the same time an unusual amount of pumping is necessary at the station in Berlin, thus causing a sudden excess of sewage. To relieve this, at each of the two central points just named there is erected a stand-pipe provided at the top with an overflow which discharges into neighboring shallow basins, sixteen in number. These stand-pipes have the appearance of small towers, their tops being twenty-one metres above the city. The plain around Berlin is thirty or forty feet above the city, and these pipes are about thirty feet above the level of the plain.

A watchman is on duty at each tower to give notice of an overflow by means of a bugle, calling the workmen to open the valves. An automatic arrangement gives the same notice by a flag, or at night, a lantern.

The fields over which we were looking contain 3,333 acres. They receive the sewage from sections 1, 2 and 3 of the 12 sections into which Berlin is divided. Five thousand cubic metres of liquid are distributed into them every twenty-four hours, of which twenty-five per cent remains as deposit and seventy-five per cent flows off as water. We were informed that for every 500 persons there is required about two-and-two-thirds acres of land, and that the area of irrigation land required is about one-and-a-half times the surface of the city drained. The fields are very level, and are divided by avenues lined by small trees and by ditches and furrows. The sections are of two sizes, the larger called meadows for raising grass, and the smaller called beds, for the growth of vegetables.

We inspected a particular meadow containing about four acres, and questioned a laborer at work on one of its ditches. It had been flooded four days before, and was to be flooded again on the following day. Its soil appeared simply dark and moist: a ditch surrounded it, two feet in width and one-and-a-half feet deep, through which the sewage fluid was slowly running. The current was made stronger, indeed quite forcible, by turning a valve at one corner of the meadow where an open ditch connects with the distributing pipe. To flood the meadow the current is put on at full force, and the surrounding ditch opened at various points on the meadow side. This

[1] A paper by Walter Wyman, M. D., Surgeon, United States Marine Hospital Service, in the *Herald of Health*.

meadow gave five cuttings of grass last summer. We saw others which had just been flooded, having the appearance of shallow ponds. About three days is required for the disappearance of the water.

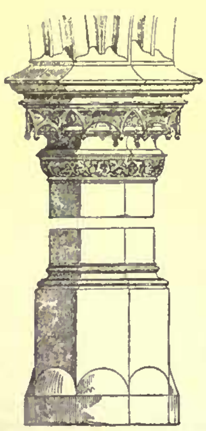
Besides grass, rye, oats, wheat, corn and hemp are raised; and in the beds, sugar-beets, carrots, turnips, cabbage and chicory. Cows are pastured in the fields and are healthy. A laborer who had been employed here for five years, asserted that there was no sickness among the workmen, except rheumatism, caused by working on the moist ground, and that sometimes in the summer strangers complain of the odor, but the workmen never. The odor is experienced in the morning when the stop-valves are opened, and gas which has accumulated during the night escapes. This passes off in a few moments. There is some stench also when the ditches are cleaned, as they must be occasionally.

The remaining point to be explained is the method by which these beds and meadows are prevented from becoming marsh-like and soggy, in other words, the drainage. They are all underlaid by porous drain tiles, placed one or more metres below the surface. Where the soil is sandy the tiles are about seven metres apart; where it partakes more of the nature of clay they are but three metres apart. The water collects in the tiles, and runs into receiving ducts which empty into a main ditch. This ditch discharges into a small stream, that flows into the River Havel. At Potsdam, the summer seat of royalty, the emperor's palace, "Babelsberg," is located directly on this river, and the water discharging into it is clear, inoffensive and free from deleterious matter.

Germans returning from America after an absence of ten or twenty years, express surprise at the wholesome change in the sanitary condition of the city; and it is claimed that the health of the sections in which it has supplanted the old cesspool system has been greatly improved.

It is considered significant that the River Spree, flowing through the city, contains many more fish than it ever did before. Certainly Berlin is a clean city. Rapidity of disposal and without offence are two characteristics of its sewerage system, and water, earth and air, all in the greatest abundance, seem to solve for it the great sewage question. In estimating the positive value of the system, one must not forget the conditions both adverse and favorable, which led to its adoption in Berlin. In the first place Berlin has no large river to receive its sewage, nor is it near the ocean. It is built in the level valley of the River Spree, which flows through a large plain. The city is on a lower level than the plain, but the soil of the latter is sandy, making the best kind of ground for the filtration of sewage fluid.

AUTOMATIC SPRINKLERS, RATES AND CONTINGENCIES.



THE *American Exchange and Review* says: There is now an experience of about nine years in the sprinkler fixtures as defensive against fire in New England mills. The New England Fire Insurance Exchange has a standing Committee on Factory Improvement and Protection, and at the last meeting of the Exchange this committee made a report especially recommending one sprinkler — a dry-pipe system:

"May 1, 1886, there are 929 establishments protected by the Grinnell Sensitive Automatic Sprinklers, with an insurable value of $200,000,000. Losses on the property protected by this sprinkler from May 1, 1882, the time when the Providence Steam and Gas Pipe Company commenced to introduce it in the place of the Parmelee sprinkler, to May 1, 1886, amounted to $12,497.92. Number of fires where no claim was made, 99; where claim was made, 20. Total number of fires, 119. Average loss to one fire, $105.02, and an average of one fire to every eight establishments. The report of the largest insurance company doing business on this class of property reports fires on the property protected by automatic sprinklers of all kinds from 1877 to 1886: Number of fires, 224; average loss per fire, $382.36."

Our contemporary adds: the committee does not appear yet to regard such rate of fire-loss as sufficiently established to warrant the reduction of insurance to, say $2,000 or $3,000 per establishment. A special committee is, however, recommended, to be called Factory Protection and Automatic-Sprinkler Committee, which is to have consideration of all questions connected with the subject. The sprinkler has not become an absolute reducer of jeopardy, being itself subject to contingencies. The committee put the following as absolute conditions for effective operation:

"1. A sprinkler should cover every part of the building, including stairways, elevators, closets and all concealed spaces.

"2. A supply of water, valves all open, and pressure on the pipes, whatever it may be, free and in working order."

Further, it is said:

"The whole sprinkler system may be the best, the water-supply ample, and yet if the main valve is closed the whole apparatus is worse than useless. With all the care used, the number of valves found closed is surprising. Sprinkler people have been working to devise some simple arrangement by which the closing of the valve would be detected and the alarm given, but as yet without the desired effect. A water-gauge above the valve and set-cocks may be of some value, but are not to be depended upon. At present the greatest care should be observed, and the main valve should be strapped open by a riveted leather strap, the strap passing around the pipe and a spoke of the hand-wheel used for opening the valve, and under no circumstance should a left-hand valve be allowed in a sprinkler system. . . . In order to reduce the chances for accident to a minimum two sources of water-supply afford the best protection. The desired pressure may be constantly maintained by a tank located above the highest point to be protected by sprinklers, by reservoir pressure through main streets, by steam-pumps having automatic-pressure regulations, and by air-pressure tanks. The size and location of the elevated tank will depend upon various conditions, including that of auxiliary supplies, but there should not be less than 3,000, and for a system of fair size 5,000 gallons and the bottom of the tank should not be less than ten feet above the highest point to be protected. Steam-pumps should be duplex and of from 250 to 500 gallons capacity; should be connected automatically and with a drip, so that the pumps may be always in working order. The size of the pump depends on the size of the property to be protected. An air-pressure tank consists of an iron tank of desired capacity about two-thirds full of water, the remaining space filled with compressed air under pressure of about eighty pounds. This may be an important apparatus for supplying pressure on the top of high buildings in cities. A force-pump may also be used as a secondary source of supply connected with the system of sprinkler-pipes; proper check-valves to be placed in the pipes. Protection by hydrants should not be overlooked, but they should be independent from the system of sprinkler-pipes."

At the present stage sprinkler protection appears to be a change in the fire contingency, attended with incidental reduction of loss. Great confidence is felt in the eventual successful establishment of the method, and thereby the mills so guarded against fire will either be kept in the specially hazardous class by small lines at specially hazardous rates, or reduced to the non-hazardous plane of brick dwelling-houses with large lines at dwelling-house rates. At the present stage, with little established that is definite, the Exchange committee recognizes that "the conditions vary with every risk," and that each case should be considered by itself. If, however, we are to understand the first paragraph quoted as meaning what it says, the variation in risk is reduced to an inconsiderable trifle, the fire cost being almost entirely eliminated — that is, reduced to less than two mills per annum per $100 of insurable value.

COMMUNICATIONS.

THE MOMENT OF INERTIA.

TORONTO, CAN., August 12, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

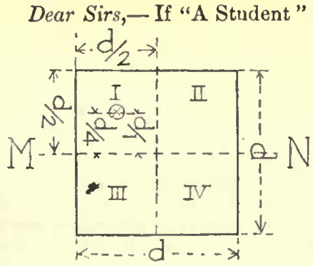
Dear Sirs,— In Article II, "Safe Building," published in your paper of April 3, is given a rule for finding the moment of inertia of the cross-section of any body, which, applied to Figure 1, Table I, gives, according to my working, $\frac{d^4}{16}$ instead $\frac{d^4}{12}$. Would you kindly oblige me by telling me how the 12 is obtained?

Yours truly, A STUDENT.

NEW YORK, August 25, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs,— If "A Student" had sent on his way of working out the problem, his error could probably be easily pointed out to him. To prove the rule correct, take the figure of a square and divide it into four simple squares, I, II, III and IV, and apply the rule, viz:



$$i = (d_{I}^2 . a_{I} + i_{I}) + (d_{II}^2 . a_{II} + i_{II}) + (d_{III}^2 . a_{III} + i_{III}) + (d_{IV}^2 . a_{IV} + i_{IV})$$

Now, considering part I, we shall have:

$$d_{I} = \frac{d}{4} \text{ therefore}$$

$$d_{I}^2 = \frac{d^2}{16} \text{ further,}$$

$$a_{I} = \frac{d}{2} \cdot \frac{d}{2} = \frac{d^2}{4} \text{ and}$$

$$i_{I} = \frac{\left(\frac{d}{2}\right)^4}{12} = \frac{d^4}{12.16}$$

Now, it is evident that as parts I, II, III and IV are all situated the same, relatively to the main neutral axis M . . . . . N, that

$a_{I} = a_{II} = a_{III} = a_{IV}$; also,

$$d_{\text{I}} = d_{\text{II}} = d_{\text{III}} = d_{\text{IV}}, \text{ and}$$
$$i_{\text{I}} = i_{\text{II}} = i_{\text{III}} = i_{\text{IV}}$$

We shall have, therefore, for the moment of inertia (i) of the whole section,

$$i = 4.(d_{\text{I}}^2.a_{\text{I}} + i_{\text{I}})$$

Inserting the values for d_{I}, a_{I} and i_{I}, we have:

$$i = 4.\left(\frac{d^2}{16}.\frac{d^2}{4} + \frac{d^4}{12.16}\right) = \frac{4.d^4}{16}.\left(\frac{1}{4} + \frac{1}{12}\right) = \frac{d^4}{4}.\frac{4}{12} = \frac{d^4}{12}$$

"A Student's" letter calls my attention to an oversight in the article in question. The third line from the bottom of the first column should read: "Distance of the centre of gravity of each part from *the neutral axis through* the centre of," etc. Still, even this omission does not account for "A Student's" error.

Yours very truly, Louis DeCoppet Berg.

RUSTY DRAWING-INSTRUMENTS.

Bridgeport, Conn., September 1, 1886.

To the Editors of the American Architect: —

Dear Sirs, — Will you please tell me the best way of removing rust from draughting instruments?

Very respectfully, A. Paddock.

[Remove it by gentle rubbing with rotten-stone and oil, and then apply a mercurial compound which gunsmiths use to protect the fine work of guns and pistols.— Eds. American Architect.]

THE LEADING AMERICAN ARCHITECT.

Philadelphia, Pa., August 13, 1886.

To the Editors of the American Architect: —

Dear Sirs, — Will you kindly (if agreeable) inform us as to who, in your opinion, is the leading architect in the United States? An early reply will greatly oblige,

Yours sincerely, R. L. Polk & Co.,
Pub. A. & B. Directory, U. S.

[We prefer to let some one else answer this conundrum. Perhaps the exalted individual has not too much modesty to declare himself.— Eds. American Architect.]

THE NORTH EASTON TOWN-HALL.

St. Louis, Mo., 1886.

To the Editors of the American Architect: —

Dear Sirs,— Please be so kind as to give me the names and *colors* of the stone used on the Town-Hall, North Easton, H. H. Richardson, Architect. Yours respectfully, F. W. Folk.

[The greater part of the stonework in the lower story and basement is a buff-colored granite, perhaps from Dedham, Mass. The arches, quoins, window-dressings and so on, are Long Meadow sandstone, of a color suggested by that in the gelatine plate in this issue. The bricks are red and the roof covering red-tile.— Eds. American Architect.]

NOTES AND CLIPPINGS

The Hours of Labor in Paris. — M. Longuet, a prominent writer on the *Justice* and a member of the Paris Municipal Council, brought forward at the last sitting of that assembly a motion to reduce the daily hours of labor in all municipal works and offices to eight. One day in the week would besides be set apart for rest. The Director of Public Works, M. Alphand, opposed the motion on the ground of expense. It was finally negatived by forty-two votes against twenty-five, and an amendment fixing the maximum day's work at nine hours, with the proviso of a day of rest, was adopted by thirty-three votes against thirty-two. — *London Daily News.*

Age of German Universities. — A comparison of the ages of the several German-speaking universities is of interest just now in connection with the Heidelberg commemoration. The oldest is Prague, founded in 1348; next comes Vienna, founded in 1365; Heidelberg follows, being the senior of the universities in the German Empire, founded in 1386; then Leipsic, in 1409; Frieburg, (Baden), in 1454; Griefswald, in 1456; Bâle, in 1460; Munich, in 1472; Tübingen, in 1477; Marburg, in 1527; Königsberg, in 1544: Iena, in 1558; Würzburg, in 1582; Giessen, in 1607; Kiel, in 1665; Halle, in 1694; Breslau, in 1702; Göttingen, in 1737; Erlangen, in 1743; Berlin, in 1810; Bonn, in 1818; Zürich, in 1838; Berne, in 1834; Strasburg, reëstablished in 1872, originally founded in 1567. — *London Times.*

A Western Fence Story. — A Nevada newspaper has outdone the Georgia liar. It alleges that some months ago W. J. Marsh, of Fort Churchill, built a fence around one of his meadows along the bank of the river, and for posts used young cottonwood and willow trees. A gate was made in the fence and an extra-heavy post was put in the ground for the gate to swing on. It was noticed that a number of the green posts were sending out branches, but no attention was paid to this fact. After cutting the first crop of alfalta in this field some cattle were turned into the enclosure through another gate, away from the river. They were soon found outside of the fence and a man was sent to find out where the fence was broken. He had found the fence all right, but upon coming to the lower gate found it raised about five feet in the air — high enough for the cattle to go under. The post to which the gate was hinged had grown that much and carried the gate with it.

Cæsar Borgia's Tomb. — A singular quest has resulted in a singular find. For some time past M. Yriarte has been seeking for the tomb of Cæsar Borgia. There were traditions to assist, but they seemed, on the whole, not very trustworthy. It was known that Borgia had been buried somewhere in Navarre. His last years had been spent as a volunteer in the army of his brother-in-law, who was King of the country. But beyond the fact that he served in the army and was killed by a musket shot at the siege of the small town of Viana, near the Ebro, nothing definite was known. It seems strange that a Prince who found a chronicler in Machiavelli and who was once the terror of all Central Italy, from the Adriatic to the Mediterranean, should have passed away with no definite note of where his ashes were interred. Had he been an ordinary exile the circumstance might have been explained. M. Yriarte has, however, had strange success. Naturally the place where investigations should commence was the town where Borgia lost his life. But the search was fruitless. Then the whole of Navarre was made the subject of inquiry. The records of churches and the archives of towns were investigated with results that only misled. At last M. Yriarte came on a clue. In the presence of the Judge of the district the street in front of the church was ripped up, and there the coffin and the body were found. It is supposed that in some early restoration of the church a by-gone Bishop of the diocese, outraged at finding so bad a man buried in consecrated ground, had ordered the coffin to be removed; but it seems strange that no tradition of the circumstance should have lingered at Viana. — *Pall Mall Gazette.*

TRADE SURVEYS

The phenomenal growth of the iron trade is shown in the recently published statistics of the American Iron and Steel Association. These figures are instructive and interesting for the bearing they have on the general construction interests of the country. Among other showings are these: Nineteen large blast-furnaces are being built, thirteen extensive rolling-mills for iron and steel, two nail factories, seven Bessemer steel-works of great capacity, two Clapp-Griffith steel-works, seven open-hearth steel-works, besides numberless smaller plants for furthering the process of iron and steel manipulation. The report shows there are fifty-seven iron rod and wire mills, twenty-seven iron nail-works, eighty-five car-works, seventy-six car-axle works, one hundred and eight car-wheel works, twenty-five locomotive works, twenty-five wrought-iron-pipe works, and thirty-one cast-iron-pipe works. There are sixty-eight rolling-mills using natural gas, and sixteen preparing for its use. The crude iron productive capacity is nearly 10,000,000 tons per annum, the iron and steel rolling-mill capacity 7,613,000 tons. There are four hundred and twenty-three rolling-mills and five hundred and seventy-eight blast furnaces. No other industry watches its progress as does the iron industry. It is therefore referred to as a trade barometer. The industries are in good condition. The fifty-seven iron-rod mills and the twenty-seven wire-nail mills, and eighty-six car-works, and seventy-six car-axle works, and twenty-five locomotive-works, and all other enumerated industrial establishments are quite full of orders. In numerous cases orders will keep works running until the holidays. The country is entering on that condition which usually precedes an advance in prices, but exceptional causes are likely to prevent any material advance, the reasons being the determination of the organized industries to not overcrowd the channels of trade, and the extraordinary demand which will engage nearly all the capacity. The danger of overdoing is present, of course. Enterprise was unduly encouraged a few years ago by the low price of labor. Its high price and the general advance in raw material will act as a break and thus help to preserve an equilibrium between demand and supply. There is, therefore, good reason for the existing confidence in trade and manufacturing circles. The week's record in railroad building is encouraging. Foreign manufacturers of iron, steel, hardware, machinery, and dry goods are doing a larger business this year, and the increased importations seem to find ready market, one very satisfactory condition of things is to be found in the general increasing demand for building material in which lumber, as usual, takes the lead. The improvement has started in the primary markets. Manufacturers themselves have inaugurated a new rule, viz., to demand and exact reasonable prices. Grain movements are fifty per cent greater this season than last. The European wheat crop is a partial failure and a heavy export-trade is counted on. All the important lines are taxed to their utmost, and car and car-wheel works have been filled up with orders. Repairing requirements on railroads and in manufacturing establishments are a very important factor. The managers of our great interests are anxious to pursue a policy which will prolong the present period of activity. Industrial development has been by leaps. It can be and will be gradual and steady as the best interests of society come to be understood.

The summary of August permits shows a very healthy condition, especially in the Middle and Western States; no drawbacks are apparent. New building and engineering enterprises are springing up. The demand for small houses is still in excess of the supply; here and there agents complain of a declining tendency in rents of older houses in large cities, but this evil will be of short duration. Rents in many places have been too high, and the trouble is only correcting itself: the outcome of all this unusual building activity will be a decline in rents; in fact, this tendency has been observable for two years or more, but it has not detered investors. The popular building and loan association system is growing quietly in the West, and is productive of good results. Architects complain, with good reason, of the utilizing of their building-plans in other enterprises than originally intended. Builders frequently dispense with the services of architects, but frequently to the disadvantage of the investor. In the Western cities, where organization is general, there is but little complaint of this kind; the services of architects are in good request there, while in some Eastern cities talent is less actively engaged. Chicago builders have had a remarkably good year. The supply of brick is twenty per cent greater this year than last, and prices are from fifty to seventy-five cents above last year's prices. In St. Louis building activity is fair, but less urgent. Large warehouses have been built, and bank and church work has been good. In Cincinnati there is a reviving activity, and architects look for more business next winter than last. In Pittsburgh work is improving. In Cleveland large contracts have just been placed for building material and supplies. In Richmond, Va., some important building enterprises are projected. Reports from several Southern inland cities indicate fair building activity. Near home, architects are quite confident, and builders have more than the usual amount of work in hand. Building-labor is in active demand. Wages are steady. Strikes are occurring here and there, but no trouble is anticipated on a large scale.

The American Architect and Building News. September 11, 1886. No. 559.

HELIO CHROME.



STORES AT THE CORNER OF BEDFORD AND KINGSTON STS., BOSTON.

H. H. RICHARDSON, Architect.

HELIOTYPE PRINTING CO., BOSTON.

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CONTENTS

TO us the most interesting phenomena connected with the recent earthquake, the most pregnant of possible future disaster, and the ones affording the strongest evidence in favor of the volcanic character of the commotion as opposed to the land-slip theory, are to be found in the underground occurrences that are, so to say, coming to the surface every day. These at once seem to indicate that the internal commotion sought relief in various and widely-separated quarters, and that heat was the initial motive power. We do not know the exact chronology of these occurrences, so we can speak of them only as we saw them recorded in various reports in the daily press. First there was the sudden overflow of a new artesian-well in Iowa, which dried up half-a-dozen wells in its immediate neighborhood, and which discharged such a vast volume of water that it threatened to wash away the town, and did overflow the bottom-land near by so as to form a small and growing lake; for the utmost efforts of local engineers, and all the talent that could be brought from Chicago could neither restrain nor stop the flow. Then the great geyser in Hell's Half Acre, in Dakotah, the largest geyser in the world, resumed operations after a rest of about seven years, and spouted up huge volumes of hot water of a temperature the highest limit of which it is beyond the possibility of science to measure. Next, a series of artesian wells in Texas, which had always given pure, sweet water, became unusable after the earthquake, because their waters had become so strongly impregnated with sulphur. And this week we noted a report from a Georgia town of an engineer of a large mill who suddenly found that no water was being fed to his boiler, and who on examination found that the artesian-well from which his feed-water was drawn now produced boiling instead of cold water, a condition of things which had put a stop to the working of his inspirator, which requires, we believe, a certain low temperature in the water which is moved by the steam jet. These facts, if facts they be, seem to show that a water-supply derived from artesian-wells is peculiarly unreliable, and cities and towns which are sinking gangs of artesian wells, as in some places in New Jersey, would do well to consider that the present cheapness of this method of obtaining water may in the end be a very costly matter, if any terrestrial disturbance should discharge into their wells a stream of hot-water, petroleum or sulphurous gas. We do not know how the water-supply of Charleston is obtained, but we presume largely from ordinary wells, and it seems to us that as sewers, drains and cesspools have probably been disrupted in many places an inquiry should be at once set on foot to discover whether the water of these wells has already been contaminated, or how soon it is likely to be by the leakage from broken containers of filth. There is not just now any place in this country we should so little care to sink a well for drinking water as Charleston, S. C.

THERE is another reason why we speak of these subsidiary phenomena as pregnant of possible future evil: they seem to presage possible ruin to those towns and cities which are wholly dependent for light, heat and motive power on natural-gas wells, if an earth fissure should either wholly release or divert into another channel this wonderful ally of modern progress. What an evil this would be can be measured by what befell Pittsburgh, when last winter some slight derangement of the supply-pipes or reservoirs left about half the citizens to freeze before fireless grates, and eat cold meals, while busy mills lay idle, and the charges in blast-furnaces grew cold. Outsiders know little of the degree to which natural-gas is now used in those regions where nature has stored it, and that from being the hobby of one or two individuals, who were looked on by their neighbors as crack-brained enthusiasts, it has become the main reliance of busy communities upon whom ruin would fall, if at any time the supply should fail. Findlay, Ohio, is one of the towns which has longest used natural-gas, for in 1838 Mr. Jacob Carr had his house piped from a well bored in his land on the main street of the town, and has burned it ever since; and for two years past natural-gas has served to heat and light the inhabitants, and operate their machinery, for the local gas company early saw that if they did not take advantage of the discovery another corporation would, and they therefore give up making artificial gas, and turned the natural-gas into the city pipes. There are now eleven gas-wells in this town, which give a constant supply, the volume of which can be measured by the fact that four of them give an aggregate yield of over nineteen million cubic feet per day, worth about eight cents per foot: of this, owing to imperfect arrangements, a large portion goes to waste, for it is estimated that during the past spring about sixteen million cubic feet of gas were wasted daily. The cheapness of this fuel as compared with coal is shown by the charges made by the local company, which are: for supply for a cooking-stove one dollar per month; for a heating-stove one dollar-and-a-half; for an open grate two dollars; for light fifteen to thirty cents per month, and for boilers one hundred and fifty dollars and upwards per year. The gas which contains 92.6 per cent of marsh-gas, 2.1 per cent of hydrogen, 3.6 per cent of nitrogen, and smaller percentages of olefiant gas, oxygen, carbonic acid, carbonic oxide and sulphuretted hydrogen is found in the Trenton limestone, about three hundred and thirty feet below sea-level, or eleven hundred feet from the surface, and so far as known is inexhaustible. About fifty towns in Western Ohio are now boring for gas.

BUT American towns are not the only ones which go to the bowels of the earth for their light and heat. We have given some account of the great oil-fields of the territory about the Caspian Sea, and the works of the Brothers Nobel, at Baku, which bid fair to have such a prejudicial effect on the American petroleum market. And now there reaches us an account of the attempt making in Buda Pesth, in Hungary, to utilize the hot-water supply which was struck last winter when boring an artesian-well in that city. At a depth of thirty-one hundred and sixteen feet a flow of warm water was encountered having a temperature of one hundred and fifty-eight degrees Fahrenheit, and the boring is being continued, in the hope of encountering water of a still higher temperature, which, if found, it is the intention of the company, which has obtained from the municipality a subvention of one hundred and sixty thousand dollars, to utilize as a source of supply for a system of hot-water heating which is to be "laid-on" throughout the city, just as the steam-supply is laid-on in New York and other places, or the hydraulic-power supply in London. Already the hot water is used in various factories, wash-houses and public baths, so that, even if water of no greater temperature is obtained, the company already has a source of income in what it has already found. If it is once proved that a municipal hot-water supply is a possible and paying enterprise, we may expect some of our enterprising countrymen to lay under tribute the numerous boiling springs there are in the West and South.

TWO or three years ago the New York *Tribune* published a serial story called, we believe, the "*Story of Mary*," which in some ways was as vivid and likely to do as much good as "*Uncle Tom's Cabin*." The writer's purpose was to show up some of the horrible atrocities perpetrated in these days in the convict camps of Georgia by the overseers put in charge of the wretched prisoners who had been hired from the State at a nominal sum to work the lessee's coal mines. The story was written by some one laboring under the lash of a generous

indignation, and gave to the reader one phase of the convict-labor question, the philanthropist's side. But, such is the sardonic irony of real life, we are accustomed to hear of the evils of the convict-labor system less often from philanthropists than from the representatives of trade-unions who seek to bring about the abolishment of the system — many of whose ways are certainly iniquitous — not through a humane desire to diminish the sufferings of their fellow creatures, but solely with a view to bettering the condition of their free fellow members, by relieving them of the necessity of competing in wages with the convicts. We believe that the injustice done to free labor through the competition of convict labor is much overated, and where it is operative is confined to limited areas, and is not at all commensurate with the benefit which the general public receives by reason of its malefactors being forced to be self-supporting in a very large degree. Congress has instructed the new Commissioner of Labor to investigate this matter, and the publication of the data collected by him will show whether the free laborer has the real grievance he now fancies he has. It seems to us that an apparently simple change in the manner of letting-out convicts to contractors would do much to diminish the present cause of complaint, and that is to require that convicts shall be leased not to the highest bidder, as now, but to the one bidding highest above a fixed minimum *per diem*, which should be the same as the minimum wage paid to free labor for the same class of work.

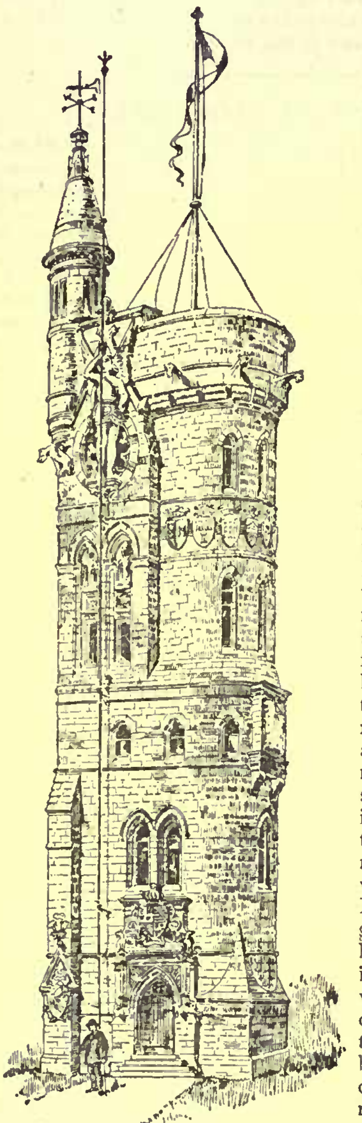
IT would not be possible for any one to foretell what novel feature of the labor trouble a week would bring to light, and yet each week develops some incident wholly unlike any that had gone before, though one might think that during the last six months the entire gamut of annoyance and unnecessary loss had been run up and down by one party or the other. The incident that marked last week seems to be more than ordinarily regrettable, as it sets an example which is only too likely to be seized on and given a vicious extension. The labor trouble in Augusta, Ga., has been attended by the usual suffering which falls on the innocent as well as the guilty strikers, suffering which it is almost as hard for onlookers who are not wholly selfish to perceive, as it is for the victims to endure. Practically the innocent have the hardest time for they are oftenest not members of organized associations and so have not even the meagre relief that is rendered by affiliated organizations in other places. The Augusta strikers are simply engaged in trying to extort higher wages from a corporation which has such hard work to keep its mills in operation that it cannot and does not pay any dividends to its stockholders, and which has showed itself to possess good feeling enough to promise its operatives that if times improve their wages shall be raised before dividends are declared. But the leaders of the strike prefer to show what they style their strength, and, rather than allow their starving fellows to earn their own bread, have prolonged the strike to such a point that it seemed imperative that relief should be afforded the strikers from some source or another. If the relief had come from private sources or organized charitable bodies no one would have a word to say against the practical wisdom of such humanity, but when it comes in the form of an appropriation of $1,000 voted by the municipal authorities one cannot but condemn the action in its relation to the special case in hand, and must consider it a most deplorable largess if it were the outcome of spontaneous human sympathy, while if it was effected by political or social manœuvring of any kind it must be regarded as the most significant event that the labor movement has developed. The possibility of obtaining from the public treasury means for prolonging strikes being once demonstrated, what is there to prevent corrupt municipal governments, such as so often have the control of the vast resources of the New York municipal exchequer, for instance, from following the example thus set, and, as it were, taxing the property-holders for means to prevent for an indefinite period their property from bringing them any income? This would be a communistic success without parallel, but yet not beyond the limits of possibility.

HOW far the educational methods applied to the masses are responsible for the labor troubles, who can say? Do they simply magnify the hardships of the mechanic's lot, or do they inculcate a spirit of philosophical endurance of evils that cannot yet be cured? The adage "there is plenty of room at the top" may hold good for individuals, but is it equally true for whole classes? The experience of Germany, which is at once the hot-bed of Socialistic movement and the centre of popular education, seems to show that the adage is fallacious, that there is such a thing as too much learning; for we have seen it stated recently that the technical schools of that country are turning out expert workmen about three times as fast as work can be found for their graduates: that is, that two out of every three are unable to find work of the kind they have been trained to do, and so must accept work of a lower grade, and perform their tasks in that discontented mood which is the favoring soil for the growth of the anarchical spirit. In this country we have not yet outgrown our needs, and we can heartily applaud what our technical schools everywhere are doing. Almost every one of our large cities has one or more of these useful schools, which are essentially similar in purpose and details of operation, and most of them give instruction to both sexes. Perhaps the most useful school is the Baltimore Manual Training School, which admits boys only, where are taught, besides mechanical drawing, the manual operations of all kinds of carpentry, cabinet-making, pattern-making, turning, founding, moulding, and all kinds of machine-shop work, besides the usual manipulations of commercial chemistry. The Pennsylvania Museum and School of Industrial Art, at Philadelphia, on the other hand, as its name betokens, devotes itself rather to instruction in the arts of technical design, and gives instruction in drawing, painting, modelling, carving and commercial designing. It has lately added instruction in the difficult art of weaving with both hand and power looms, and has placed the department under the charge of a graduate of the Government Advanced Weaving School of Reichenberg, Austria. This is one step in advance of the Lowell School of Design at Boston, which trains boys and girls for positions as designers in mills of all kinds, but does not, we believe, familiarize them with the work of translating their designs into thread. It would seem as if the graduates of either school might take a final polishing through a term or two spent in the other institutions.

IT will be remembered that some two years ago an effort was made in England to diminish the competitive evil by inducing the members of the Royal Institute of British Architects to sign an "undertaking" not to take part in any competition the programme of which did not contain certain minimum requirements necessary to assure equitable treatment for the competitors taking part: chief amongst these requirements was the employment of a professional assessor. Some thirteen hundred architects signed the undertaking, and we are hence led to infer that they abstained from competing except where the requirements were complied with. The Special Committee in charge of the matter has recently reported on the working of this scheme by publishing a summary of the competitions which took place during two years preceding the agreement and during the two years which followed it. It appears that during the first period there were one hundred and twenty-five public and limited competitions, in twenty-five per cent of which assessors were employed, while in the second period there were one hundred and thirty-nine public and limited competitions, in thirty-two per cent of which assessors were employed; so that the scheme may be credited with a gain of seven per cent in two years, which is, perhaps, all that could be hoped. On the other hand, there seems to have been a falling-off in the employment of assessors in limited competitions where, the terms of competition being usually fairer than for public scrambles, we should have expected that the greatest gain would have been made. Before the signing of the undertaking twenty-two per cent of limited competitions were settled with the help of professional advisers, while after the defensive alliance was formed only fourteen per cent of limited competitions were adjudged in compliance with the professional requirements. We hardly think the circumstances warrant us in drawing any conclusion, for it may be that the improvement in the particular direction of the employment of a professional adviser is simply the result of a "new-broom" attempt to better things, or it may be that the gain will be greater as time goes on and the general public is educated to appreciate the advantages to itself which generally would result from unprejudiced professional assistance. Of one thing we feel certain, that under even the best possible conditions public competitions — except in very exceptional cases — will never attract the best men. If committees wish to have the benefit of the help of the best men, they must conduct small limited competitions, and must base their programmes on the most equitable lines that expert advisers can formulate.

AN EDITOR'S TRIP ABROAD.[1]—XIII.

THE MUSEUM, THE RAILWAY STATION AND THE CATHEDRAL AT AMSTERDAM.—THE HAGUE.—THE PALAIS DE JUSTICE, BRUSSELS.



PROPOSED METEOROLOGICAL OBSERVATORY. FOR BRISTOL CHANNEL. EDWIN SEWARD. A.R.I.B.A. ARCH'T.

ALTHOUGH some of the inhabitants think that the prosperity of Amsterdam is declining, it seems to be still rich enough to provide for the simultaneous erection of three of the largest and most costly buildings in Holland; the most important of the three being the new Rijks-Museum, which has just been opened to the public, while Mr. Springer's Central Railway Station, still in process of construction, follows pretty closely after, and the new Catholic church, whose lofty cupola dominates, in a distant view, the whole northern portion of the city, promises to be nearly equally interesting whenever it is completed. As specimens of brick architecture on a large scale, all three are of great value. In the church stone is used so liberally and with such good taste as to bring the style nearly to that hybrid between stone and brickwork which is found in the best of the older buildings of the country, but the railway station and the museum form types of a tolerably pure brick architecture, rather plain in the first instance and highly ornamented in the second. Of the two, the railway station seemed to me the more successful, notwithstanding the study which Mr. Cuypers, the very distinguished architect of the other building, had evidently lavished upon it. In Holland, which is above all others the country of brick architecture, the essential roughness of brickwork and its lack of susceptibility to any kind of ornamentation ought to be understood, but the front of the museum, instead of presenting such broad, lightly-textured surfaces, emphasized by a few coarse, effective lines, as an Italian would have given it, was speckled with colored tiles and bits of sculpture, which destroyed the simplicity of the great building, while they lost nearly all their own force by being set in the middle of the mottled red-brick wall; and there was nothing in the outline of the building or the grouping of the masses to give it any special interest apart from the decoration. In regard to the inside, it seemed to me that the Dutch tax-payers might find more to criticize than an architect would. Large as the building is, covering some three acres of ground, the whole of the finished portion is completed in a style of magnificence which recalls Paris rather than homely Holland. In fact, even an architect, pleased as he would probably be with the beautiful vaulting in white brick, and the well-studied detail of the sumptuous rooms, might say with some reason that the structure seemed too large and costly for any collection of pictures that it was likely ever to contain, to say nothing of its disproportion to those at present in it; and to this oversumptuousness is added a certain complexity of plan which deprives the building of the sort of dignity which might have been more easily and cheaply secured than any other. The main vestibule, which is a noble room, well planned, and not, perhaps, too stately for the central point of so large a building, opens, on the second floor, first into a vast corridor, paved with mosaic and richly decorated, but containing no pictures nor any place for them, the walls being entirely replaced by piers between which open large alcoves, like the chapels of a cathedral, and in these are hung the pictures, lighted from windows, while various exits among the alcoves lead to the other portions of the building. Each bay is devoted principally to the works of a single painter, which is, possibly, a convenience to the student; but here the advantages of the arrangement seem to end, and one hardly knows, on entering the room, whether to regret more that so much money should have been spent on space not available for pictures, or that the effect of the room itself should be so marred by the irregular edges of the pictures in the alcoves which thrust themselves out, by the effect of perspective, in square, black masses from behind the piers. As one passes through this grand gallery, various other apartments become visible, all seductively lined with pictures, and apparently of equal importance and interest, and there would be a certain embarrassment about choosing which to enter first, were it not for the presence of a great number of zealous officials in uniform, who not merely direct but almost thrust the tourist into the room which the administration thinks it best that he should next enter, and, the same method of guidance being applied in each successive room, he arrives again at the vestibule, on his departure, with a sense of having been bunted about the building, which is not very pleasant. The remaining rooms are much better, in regard to the space which they afford for pictures, than the grand gallery, and the arrangement first devised, apparently by the architect of the Old Pinakothek in Munich, under which small rooms, or cabinets, are attached to the large galleries for the display of small works belonging to the same school as that to which the larger room is devoted, is reproduced in a manner less simple, but still very convenient. One can easily forgive a new museum of pictures, especially one on so large a scale, for being somewhat thinly furnished, as acquisitions are sure to be rapidly made, and the Amsterdam authorities have done the best with what material they had, filling up their space after having apparently displayed all the ancient works, good, bad, and indifferent, that they could get hold of, with some beautiful modern pictures, many of which appeared quite as worthy of lasting fame as the average of the old ones. So far as the plan of the building permitted, the pictures were displayed, as it seemed to me, with remarkable care in arrangement and lighting. The most noted work in the collection, Rembrandt's "Night Watch," which has been the pride of Amsterdam for many years, was, indeed, perhaps a little too carefully illuminated, the light being thrown upon it from above, with a thick screen hung under the ceiling, to shield the skylight from the eyes of the spectator, somewhat after the manner in which Mr. Bierstadt's works used to be displayed to an awe-struck audience. The effect was rather brilliant, the picture so shown attracting attention even through the doorway from the other rooms; but Rembrandt's contrasts of light and shade hardly need artificial heightening, and the effect gave to the picture a theatrical air which was not quite satisfactory.

In size, the Museum is almost rivalled by the Central Station, but the latter is, for the most part, quite simple in decoration. Some sculptured bas-reliefs are apparently intended for the recesses at present left in the low towers which flank the entrance, and this portion of the building has some other carved and colored ornament, but the rest is left with simple corbellings, or arcadings of moulded brick, to carry the main lines around the building, and the outline is well studied, but not complicated. What the plan might be I could not tell, the approach to the work being interdicted, but, except for details of arrangement, the disposition of parts would naturally be similar to that of most other large terminal stations.

The new church, the most interesting building, perhaps, of the three, since it possesses a lofty dome, which is always an object of curiosity to the architect, was practically more inaccessible than either of the others, since it was encumbered by a mass of scaffolding which obstructed the approach even to the outside. The style, however, which was a sort of conventional Romanesque, very much like that practised by the architects of modern French churches, seemed promising, and as stone was very liberally used with the brick and both well arranged and well cut, another year or two will apparently put Amsterdam in possession of an admirable church.

At The Hague, the largest of the modern buildings seemed to be the new Ministry of Justice, a very pretty and interesting structure, in the half-brick, half-stone style of the best Dutch sixteenth-century buildings, but with a strong mediæval flavor, derived, perhaps, mostly from the four-centred doorways and the detail of the metal-work. Independent of any local style the building would have been charming for its outline, and the effective placing of the openings, as well as for the detail; but it was thoroughly Dutch, much more so in fact, than any other large building in the city, which has very few Dutch characteristics. The Government of Holland is poor, and is judicious enough not to spend too much money on public buildings, so that the only other structures of much interest were the new dwelling houses, many of which were to be seen on the streets bordering the park. Unlike Amsterdam, which has very few inhabitants of rank above that of a simple citizen, The Hague is the winter residence of many of the Dutch nobility, as well as of all the foreign ambassadors to Holland, with their trains, and of some hundreds, or possibly thousands of English people, who like to live in a pleasanter climate than their own. All these persons enjoy nice houses, in open and airy situations, and most of them can afford to have such houses, so that the number of comfortable mansions in the city is unusually large, and the "Bosch," or park, which is simply a beautiful artificial forest of enormous trees, with a few open spaces here and there, and a lake into which the trees dip their branches, is fast being surrounded by those semi-suburban houses, half palace-like in the reserve of their court-yards and hidden gardens, and half open, with bourgeois simplicity, to the gaze of the multitude, which please the taste of the lesser aristocracy. Being in Holland, these mansions, with their little gardens and grounds, are of course pinks of neatness, and although, being mostly of stucco, they lack the richness of stone buildings, there is a great deal that is

[1] Continued from page 122, No. 559.

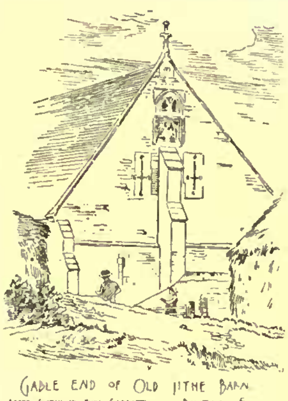
interesting about their visible planning, and the details of their execution.

After so much brick and stucco, it was rather a relief to come, in Brussels, to a city of stone architecture, and after the comparative poverty and flatness of Holland the wide streets, the perspective effect of which was much heightened by the undulation of the ground, and the great palaces and hotels seemed particularly imposing. The new Palace of Justice being near the hotel, it was not long before I found my way there, only to meet with disappointment. Huge, highly finished and costly as the building is, it cannot, as it seems to me, be called even moderately successful as a design. According to the guide-book, its style is intended to be an adaptation of the Assyrian, but nobody knows much about the appearance of Assyrian buildings, and none of the representations which exist look anything like the Brussels structure, so that the Assyrian element must, apparently, be confined to the detail, of which there is a certain amount with a Ninevite flavor, mixed, necessarily, since no Assyrian prototypes for them exist, with innumerable capitals, shafts, bases, mouldings and enrichments of other kinds, selected rather indiscriminately from the Greek, Roman and the French Neo-Grec. In fact, the detail of the building gave me the idea that the architect having the task placed upon him of immortalizing himself, had first made a pretty close study of Duc's famous building and of the other Neo-Grec work in Paris, and had then set himself to surpass them all, by the astonishing novelty of a design not merely Neo-Grec, but Neo-Grec-Assyrian. It would be a misfortune for architecture to have such an attempt succeed, and the greatness of the scale of this one did not save it. In such an imaginative, undefined style, everything depends upon the artistic capacity of the designer, and some of the Neo-Grec work is heavy, irrational and offensive in the same proportion that the best examples are interesting and beautiful, and Poelaert seems, not exactly to have chosen the worst prototypes, but to have fallen into the same difficulties as the authors of the least successful buildings in the styles. Instead of being broad, quiet, and delicately detailed, his building, like some of theirs, is lumpy and full of unexpected awkwardnesses. An architect is usually fond of trying to account for the peculiarities of a building or a design, and many of those in the Palace of Justice could, it seemed to me, be explained by supposing that its author had built it from the elevations, without studying it in perspective, or even casting the shadows with the proper accuracy and force. Most of us know from experience, the results from carelessness on these points, and one could hardly help feeling that the designer's drawing-board had constantly misled him with combinations of lines which, graceful as they might be in the geometrical sketch, took a very different appearance in execution. The most striking example of this that I noticed was in the dressings of the inner opening of the main entrance to the *Salle des Pas-Perdus.*

In this place the door-way was trimmed with a simple moulded architrave, with a pediment over it, which seems to have been intended for Doric, and probably looked very well in elevation. Unfortunately, the door was flanked on each side by a column, so close to the opening as to interfere with the ends of the pediment. Naturally enough, it looked well on paper to show the ends of the pediment in front of the columns, and if the latter had been only pilasters of slight projection the whole affair would have looked equally well in execution. As it happened, however, the columns were round, and the pediment had to be thrown forward inordinately to get it far enough in advance of the columns to have the returns profile against them. This made a heavy lump of what was probably intended to be a light dressing, and a belated and most unsuccessful effort seemed to have been made to relieve it by putting underneath it, in the narrow space between the corona of the pediment and the outer moulding of the architrave, a row of very flat modillions, or rather cantilevers, so thin at the front as to look like the edges of mutules, and pinching themselves into their narrow quarters in a way very suggestive of the devices which occur to the amateur architect when he finds that things are not coming just as he expected.

A still more unfortunate example of the same sort of miscalculation was, as I thought, to be found in the main door-way, a portal of immense size and massiveness. This was evidently intended to be very rich in design, and consists of two or three successive planes, the outer one containing an arch, within which, in elevation, is a pediment surrounded by rich sculpture, and within this again a square-headed door-way, with more sculpture about it. The detail here was rather strongly Assyrian, and in line elevation the composition must have been original, and perhaps very beautiful. In execution, however, the planning brought the pediment, with the bas-reliefs around it, so far behind the enclosing arch as to be almost completely in shadow, where their beauties are lost to the spectator at a distance, while the gigantic arch, which is considerably higher than the main walls, being detached sharply by the shadow which it casts, straddles over the entrance in a way which suggests that the building might walk out of its own door without much difficulty. Inside, the famous *Salle des Pas-Perdus* is very nearly spoiled by the same want of comprehension of the effect of the projections. Enormously high as it is, three hundred and twenty feet from the floor to the underside of the dome which forms the ceiling, the upward view is so interrupted by obtrusive bands and cornices as to make the room look, so to speak, rather long than high, and it is far from producing the effect of many much less lofty halls. So far as the execution of the building is concerned, nothing but the highest praise can be given it. The stonework, in large blocks of Echaillon marble and a bluish limestone of similar character, is perfect in workmanship and finish, and in comprehension of the position of each block; and the detail, much of which is in very low relief, is cut with exquisite sharpness and delicacy. Taken altogether, it is, with all its weak points, a most interesting building, and it is pleasant to find that the people of Brussels so far appreciate it as to have given the square upon which it fronts — one of the most central and commanding spaces in the city — the name of the architect.

ART IN ALSACE AND LORRAINE.[1]



GABLE END OF OLD TITHE BARN. PILTON, ENG.
AFTER SKETCH BY THOS GARRATT.
A A SKETCH BOOK, LONDON.

IT is always interesting to study a portion of the history of art from a local as contrasted with a broadly-national point of view. National characteristics themselves are thus brought into stronger relief — or, more exactly, one phase and aspect thereof is shown with a distinctness it can hardly have when discussed together with other phases, other aspects. And it is both pleasant and useful, moreover, to have those creative spirits to whom a province or a district or a city has given birth, grouped for us in a separate frame. Their individualities and their mutual relationships are thus explained and — having gained in our mind a local habitation as well as a mere name — they are more clearly remembered and more sympathetically understood. And, in conclusion, a history of this sort (if at all portable in shape) supplies us with a valuable hand-book for possible occasions of travel.

The especial local history from which I am now about to quote a little is, however, a large quarto which no tourist would care to take about with him; and it differs radically in the character of its subject-matter from most others of its class. Lying between France and Germany, the meeting-place of alien races and alien tongues, at one time German, at another time French in political affinities and social affections, Alsace and Lorraine do not furnish us with a theme marked by intrinsic unity or by any strong individuality of its own. The art which grew up within their borders had no independent local root though, of course, it exhibited some characteristics peculiar to itself. It resulted from the mingling of French and German influences and its characteristics are but a natural consequence of this mingling. And the artists with brush or chisel whose names this book collects together for us are ranked, in the general histories of art, some as members of the Gallic and some as members of the trans-Rhenish school. But for these very reasons, the volume, if written from a truly impartial and scientific point of view, might have had a very special interest and value. Then, of course, it would have addressed itself directly and frankly to these facts I have noted — would have sought to unravel the threads of Gallic and Teutonic influence and to show, now how they commingle and now how they become purely French or purely German. But perhaps in this present day no patriotic Frenchman could be impartial. Certainly our author does not even make the effort. Alsace and Lorraine to him are Gallic — first and always and altogether. I remember to have read some years ago an interesting series of papers in the *Zeitschrift für Bildende Kunst* which dealt with the architecture of these same lands; and I wish I had it by me now for comparison; for, as I recollect, in the eyes of *this* author, the development of the provinces was just as wholly Teutonic; and from a collating of the two something like the veritable truth might have been arrived at. Yet M. Ménard's book contains much of interest and of value, and I do not think he would be likely seriously to mislead any advanced student; — partly because his partisanship is very frank, naïf and palpable, and partly because he does not go very seriously into the lower strata of his subject. He writes in a general, and popular rather than a scientific or an antiquarian spirit, and simply describes much more often than he criticizes. His work cannot but be instructive for the systematizing, though not greatly for the deepening or clarifying of knowledge; and it is doubly welcome as it relates to a land which is less often visited (if we except the city of Strasburg) than either of its mother-countries.

The volume falls naturally into two divisions, one treating of Alsace and the other of Lorraine. And each of these divisions is composed of two sections, the first historical and the second topographical in scheme. That is, M. Ménard traces briefly in the first place the course of art in the province and names its most important representatives (giving much more space to painting than to architecture and consequently much more to modern than to elder times), and then takes us a little journey from town to town and points out what things of interest may be found in street or museum. The plan is excellent, of course — is not the author a Frenchman?

Beginning at the beginning (with an introduction that deals with both the provinces) we learn that the country has but scanty relics of ante-Roman times to show. There are a few relics of walls built with undressed units, and a few large stones resembling the *menhirs*

[1] *L'Art en Alsace et Lorraine.* Par René Ménard. Paris: Librairie de *L'Art;* Charles Delegrave.

of Brittany and Maine; and, of course, a number of minor objects, prehistoric and later in date; though the richest collection of these (a very rich collection indeed in the Strasburg Museum) was destroyed at the time of the recent German occupation and not so much as a *càtalogue raisonné* has been left behind.

When the Romans came and gradually occupied the whole of Gaul, several important routes led through these provinces to the more remote, and they were covered with structures of every kind. But so many and so fiery have been their military trials during the eighteen centuries since, that scarce an important work survives save the aqueduct of Juoy near Metz. But innumerable smaller works of art fill the local museums or are to be found in others on both sides of the Rhine — enough to prove that Roman industrial art flourished here with peculiar strength. Tombs also exist in the Vosges mountains which have peculiar characteristics of their own. Some of the funeral *stéles* now in the museum at Saverne, for instance, must be very interesting, as M. Ménard describes them as being ornamented above with carved foliage and pierced below with arched openings, the arches in some cases being *pointed* in shape. More exactly he does not picture them either in words or in illustrations.

Only a few large statues of this epoch have been found in the provinces, but statuettes are very abundant. The majority represent either Mercury or Hercules, Mercury being the greater favorite of the two. As in one of his phases he was the guardian of routes and the protector of travellers, M. Ménard finds his cult naturally predominant in a land which was, as I have said, a great highway between Rome and Eastern Gaul and was constantly exposed, moreover, to the incursions of the barbarians from beyond the Rhine. A local legend brought Hercules himself into Alsace, and told how he once forgot his club at Colmar. Even in our day, this club — pictured as a sort of mediæval mace — is the only object emblazoned on the shield of the city. Truly, the old gods are not quite dead!

M. Ménard concludes his introduction by a bold plea for the Gallicism of all art except, of course, the pure Roman, which has left a trace in either province. The race, he says, is still the indigenous Gallic race. The Romans subdued but did not exterminate it; and the German invaders of a later time left the stock unchanged — indeed, in his view, even unleavened. The fact of the Germanizing of the local speech he regards as quite unimportant. "Everything that speaks German" he says, "belongs to the German family — this is the principle so cleverly applied by Teutonic covetousness; but there is one fact which remains inexplicable. How is it that artistic aptitudes are to be met with precisely in that part of Germany once inhabited by the Gallo-Romans while the most absolute sterility is to be found in the purely Teutonic portion. If we consider the map we are convinced that the artistic development of modern Europe never crossed the Rhine or the Danube which formed the precise boundaries of the Roman empire. The Rhine in particular forms an almost absolute limit in artistic geography. Cologne, Mayence, Spires, Worms, Wissembourg, Strasburg, Basle — all the towns which contain famous monuments — lie on the Gallo-Roman bank of the river. The only important edifice which is placed on the other bank — the cathedral church at Freiburg in Breisgau — stands on a spot where the Romans established themselves, as in an outpost, in early times. The ruins of Roman baths at Baden-Willer and of others which have left traces in this part of the duchy of Baden, indicate the presence of a fixed Roman colony. Bavaria, whose ancient population seems to have been in great part related to the Celtic races, also received Roman colonies and has also proved itself possessed of artistic aptitudes for which one would vainly seek the equivalent in those parts of Germany where the Latin element has played no part."

If we try to decipher from this and many analogous passages just what it is that M. Ménard believes as an historian of art, we are left in some doubt between two interpretations. Does he think that Celt and Latin were akin in blood and artistic aptitude and that the influence of the latter merely helped the development of the former without altering the course it would in any case have taken? Or does he think that the Latin influence was the one great factor and that it simply found better ground to develop in in Gaul than it would have found in Germany? I cannot make quite sure which belief it is he holds; but in either case the Teuton is wholly left out in the cold. Of himself he could accomplish and has accomplished nothing; and when he had been influenced by the Roman or later (as we shall soon find our author noting) by the Frenchman — even then his creations are entitled but to an inferior rank. It is certain that there is a measure of truth in the theory which allows to French art a stronger influence over German development than is currently accorded — a much stronger influence than German historians are content to recognize. But it is just as certain that M. Ménard's way of putting the theory is far enough from the right way. But this is not the place to argue the matter nor is mine by any means the pen to do it.

The names of the earliest local architects (I speak first of Alsace) certainly have a Gallic, and not a Teutonic sound. Dragobod, Abbot of Wissembourg and Bishop of Spires, heads the list in the seventh century, but is known to us by name alone. Drogon, Bishop of Metz in 825 was a natural son of Charlemagne, and it is believed that the present façade of the church at Marmoutier was of his creation. Willo lived in the eleventh century, and is reputed to have been a very versatile artist, excelling especially in goldsmith's work.

As we might expect, among the most important existing relics of these very early times are the miniature paintings wrought for the many local monasteries. The finest work of this sort which the province possessed, and one of the finest to be found in any land, was an enormous volume — M. Ménard says he is tempted to name it a "monument" — called *Hortus Deliciarum*, the many paintings of which formed an entire system of Christian symbolism. Alas! that one must speak in the past tense—it was destroyed at the time of the German entry into Strasburg. Several full-page illustrations are, however, given with M. Ménard's text, reproduced from tracings fortunately made ere the work had perished. They are strongly Byzantine in feeling, and stand high among their class by reason of the nobility of design, and the strength of picturesque imagination they reveal. As always in Byzantine-tempered work of the later periods, we note a curious intermixture of Pagan and Christian motives, and a curious twisting of the former to express the ideas and beliefs of the new cult. It is interesting (at least to me) to find that this great book was the work of a woman — Herrade of Landsberg, Abbess of Hohenburg, daughter of a nobleman who was the vassal and friend of Frederick Barbarossa. She was born between the years 1125 and 1131, and her instructor in art is supposed to have been another woman — Relinde, her predecessor in the abbatial dignity.

Of course M. Ménard opens his chapter upon the history of the Pointed style in Alsace with another plea for Gallic influence; and equally of course we are better inclined to grant his assumptions here than with regard to Romanesque developments. This was the period when the architectural profession began to lie less wholly within the hands of the Church and more within the hands of laymen. It is the period, says our author, when the Freemasons first appear in history (I need hardly point out that he can be no Freemason himself, or he would be content with no such mere mushroom existence for the society); and Strasburg was the centre of the organization. "It is by the aid of this institution that in the thirteenth and fourteenth centuries ideas and tastes in art were transmitted from one country to another. The Freemasons of Alsace went to draw from the Ile-de-France, Normandy and Burgundy, the principles which they applied in their own country, and carried afterwards beyond the Rhine. The mysterious Albert of Strasburg, is considered to have been the organizer of Freemasonry, but the traditions which concern him are legendary rather than historical. The society was already strongly established in the days of Erwin von Steinbach" (I translate into the familiar form though the author writes the name, of course, with a *de*) "but arrived at its highest development with Dotzinger, and only lost its active importance after the Reformation period. Thus the three names with which Freemasonry is bound up, belong to the history of art in Alsace." Architecture, I repeat, now passed out of the hands of the clergy and into those of lay professors. The first of these in Alsace whom we know by name is Hermann Auriga, who flourished at the dawning of the thirteenth century. He was chiefly employed in civil and military constructions, especially in those of Strasburg itself, but is also the first builder whom we can connect with the great church of the town. The Romanesque portions of the cathedral—the choir and the south portal—are commonly attributed to him. The latter, however, is more properly transitional than Romanesque in style. The sculptures which adorn it are very remarkable. Its principal figures, representing the church and the synagogue are of not uncommon recurrence in Continental towns, but only, I believe, in those where the Jewish element was conspicuous in the population. The Strasburg pair are among the finest of their kind—our author says are the very finest—so it is again pleasant to note that history (not through legend, but by the witness of a well-preserved inscription) gives them to us as the work of a woman. Savine, or Sabina was undoubtedly their sculptor though she could not have been, as was formerly supposed, the daughter of the great Erwin. Her date is too early for such parentage, and if, as our author says, it is but natural to believe that she was related to some one who was in authority over the structure, this person was very likely Hermann Auriga. To her hand has also commonly been attributed the so-called "angel pillar" in the interior of the cathedral. But this, according to our author, is a work of pure Byzantine flavor, and therefore still earlier in date. From the illustration he gives, however, the architectural details appear to be transitional and *not* pure.

William of Marbourg was long declared to have been the only architect concerned in the building of the beautiful Church of St. Martin, at Colmar. But as he died in 1366, and as the structure is largely of the thirteenth century, it is not surprising that a M. Hugot, librarian of the town, should have been prompted to search for more reliable facts. Among the sculptures of the St. Nicholas portal, the oldest feature of the church, he discovered a full-length seated figure holding architectural implements, and beside it, written out in full, the name "Maistre Humbret." Therefore to this hitherto unknown hand may be attributed the chief portions of the church, and to William of Marbourg only the choir and certain minor parts, which are fourteenth century in style.

Passing over one or two less conspicuous names, it is interesting then to read what our author has to say of that great Erwin, whose name is more familiar, alike to students and to the outer public, than that of any other mediæval architect. It is needless to remark that he combats the beliefs which would make him of German birth. The name *Erwin*, he argues, does not appear in the German language until after this period, and is probably a Teutonic version of the

French "Hervé," or the older "Herpuin;" and *Steinbach*, in the same way, was probably a translation of some such Gallic name as "Pierrefont." "Moreover, the epitaph on Erwin's tomb does not indicate his birthplace, and the title *Steinbach* appears for the first time in an inscription of a period much later than that to which the illustrious architect belonged. . . . Unfortunately, the systematic destruction of the Strasburg library by the Germans, and of all the documents which it contained, obliges criticism to content itself with simple conjectures.

Erwin worked on the cathedral for many years prior to his death in 1318; but a fire which burned all his scaffoldings in 1298, and also destroyed the timber roofing of the nave, interfered so sadly with the progress of the work that it was far from being completed by his hand. The magnificent façade, however, is sufficient by itself to entitle him to the rank he has always held among his fellows. The spire, which is popularly considered the great glory of the structure, but which certainly bears an inharmonious relation to the lower parts of the façade—was not contemplated in its present form by Erwin, but was a later addition. Its history is by no means clear, but its seems as though the John Hultz, of Cologne, who is credited with its creation was two persons, and not a single artist. M. Gérard, who has inquired very closely into such questions, is cited by our author as believing that an elder John Hultz determined the shape of the octagonal tower, and conceived the idea of the four spiral staircase turrets; that the Juncker of Prague carried the work up to the springing of the spire, and that the younger John then constructed this.

Jost Dotzinger, of Worms, worked upon the cathedral at a still later day, and erected the rich Flamboyant font in 1453. As has been said, his figure is important in the history of Freemasonry. Owing to his influence the centre of the organization was definitely fixed at Strasburg, and all other lodges were subordinated to hers in which, of course, the cathedral architect ruled. It retained its supremacy on both sides of the Rhine until in 1707, the diet of Ratisbon decreed that no German city should receive laws from a French town. But by this time the practical importance of the association had long been lost.

The pictures given with this chapter of Dotzinger's font and of the St. Lawrence portal of the cathedral (which was built by Jacob of Landshut, in 1494), by no means incline us to accept M. Ménard's belief in the purely French spirit of all local art. The font, as I have said, is of rich Flamboyant work, but its design is by no means so graceful as we commonly find in true French work of the period, while a distinct German accent speaks in certain of its details. In the portal — which is forty years later in date — Teutonic feeling is still more strongly marked. It is a most interesting work, as showing the dawn of the Renaissance in a way at once very clear and very charming. The opening is square-headed, and though the details of its stone-work are Gothic, those of the door itself are largely Classic. Above the opening, in a recess formed by open canopy work designed as three sides of an octagon, is an admirable sculptured group representing the martyrdom of St. Lawrence; the portals are flanked by very elaborate polygonal piers, bearing numerous full-length statues, and finished as rich and lofty pinnacles; and the whole composition is crowned and united by an open parapet. The sculptures were executed by John of Aix-la-Chapelle; the main group is strongly mediæval in accent, and the flanking statues also show the lingering influence of the elder school, although there a rather awkward and exaggerated effort after classic freedom is perceptible in their draperies. The general effect of the portal as a whole might be counted French, but most of the architectural details are thoroughly German in form, "stump-tracery" being profusely used though rather more gracefully managed than is customary in purely Teutonic work. On the whole, the portal is, I repeat, a singularly interesting example of how *three* tendencies may meet and mingle together in a work which yet preserves unity of effect and much vigor and beauty. M. G. van Rensselaer.

The Illustrations

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

THE ROTCH TRAVELLING SCHOLARSHIP DRAWINGS.—PLATES XXIV, XXV, XXVI, XXVII.

[Issued only with the Imperial edition.]

UNITED STATES COURT-HOUSES AND POST-OFFICES AT ROCHESTER, N. Y.; NEW ALBANY, IND.; TERRE HAUTE, IND.; CARSON CITY, NEB.; AUGUSTA, ME.; LEXINGTON, KY., AND MARQUETTE, MICH. MR. M. E. BELL, SUPERVISING ARCHITECT OF THE TREASURY DEPARTMENT.

Color-Blindness. — A Parisian physician has brought before the French Academy of Medicine the results of his investigations concerning color-blindness. He has examined 11,175 persons. Two of these only were incapable of distinguishing one color from another, three were blind for red and six for green, eighteen could not distinguish green from red, fifteen saw no difference between green and blue or gray, and fifty-two had a peculiar weakness in color vision in general. —*New York Commercial Advertiser.*

LIGHT AND WATER-COLORS.

A Reply.



It would have been far from my wish to break a lance with so formidable an antagonist as Mr. J. C. Robinson had not the opening of the controversy in the *Times* assumed the character of a challenge to those who practise water-color painting, as well as to collectors and the custodians of our museums. I venture, therefore to enter the lists as a humble representative of the challenged party upon the understanding that, in this capacity, I am entitled to the choice of weapons.

The weapon I select without hesitation is a plain unvarnished statement of facts, together with such inferences as may be drawn from the study of a question that has occupied the attention of water-color painters long before the present discussion arose.

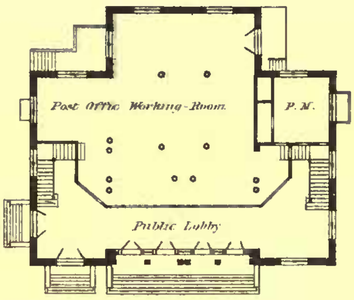
Convinced that *ad captandum* arguments and the recourse to exaggerated statements only divert the attention from the real issue, I will endeavor to summarize as briefly as possible the several phases through which the question has passed, and then enter upon the consideration of individual cases.

The project of lighting up the National Gallery, so justly condemned by the authorities of that institution, led naturally to the consideration of a kindred question — the condition of the valuable and representative collection of water-color drawings at the South Kensington Museum. Mr. J. C. Robinson, doubtless from a laudable desire to secure the safety of our public collections, drew attention to the deleterious influence of daylight upon water-colors, instancing the present condition of the South Kensington drawings as a proof that these works could not be exposed without risk to the light of day; but Mr. Robinson appears not sufficiently to have considered that there are other influences besides light which work prejudicially upon water-colors, such, for instance, as damp and impure air. A careful examination of the collection has convinced me that the last two agencies have been at work in several of the instances brought forward in evidence of the injurious effects of light alone. Now, as the arguments against the exposure of water-color drawings upon our walls rest chiefly upon the assumption that daylight is their greatest enemy, I wish to point out that as regards their safety from damp, impure air, and mechanical injury from abrasion and careless handling, they are better protected when placed in frames covered with glass and sealed at the back than when they are kept in portfolios or in drawers.

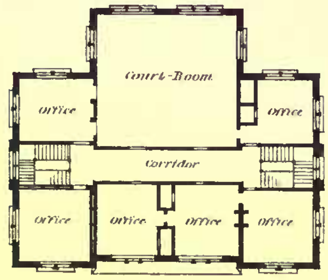
When the results of the official inquiry into the merits of this difficult and complex question become known, the public will be in a position to judge how far the serious accusations brought against an important department of one of our principal museums are justified by the patient and searching inquiry that is being instituted. That the decision arrived at will be an impartial one and lifted above the heated atmosphere of a newspaper controversy there can be no reason to doubt. I may be permitted, however, in the interim, without in any way prejudging the case, to record a few facts that have come under my notice during a very careful survey of the South Kensington Collection, tending to prove that the danger of exposure to light has been greatly exaggerated.

The bearing of the very beautiful collection of early English water-color drawings now on view at the Royal Institute upon the question at issue will next engage my attention, and here I have been so fortunate as to procure, in a large number of cases, exact and perfectly trustworthy data from which to form a judgment both as regards their present condition and the circumstances under which they were placed previous to their exhibition on the walls of the Institute.

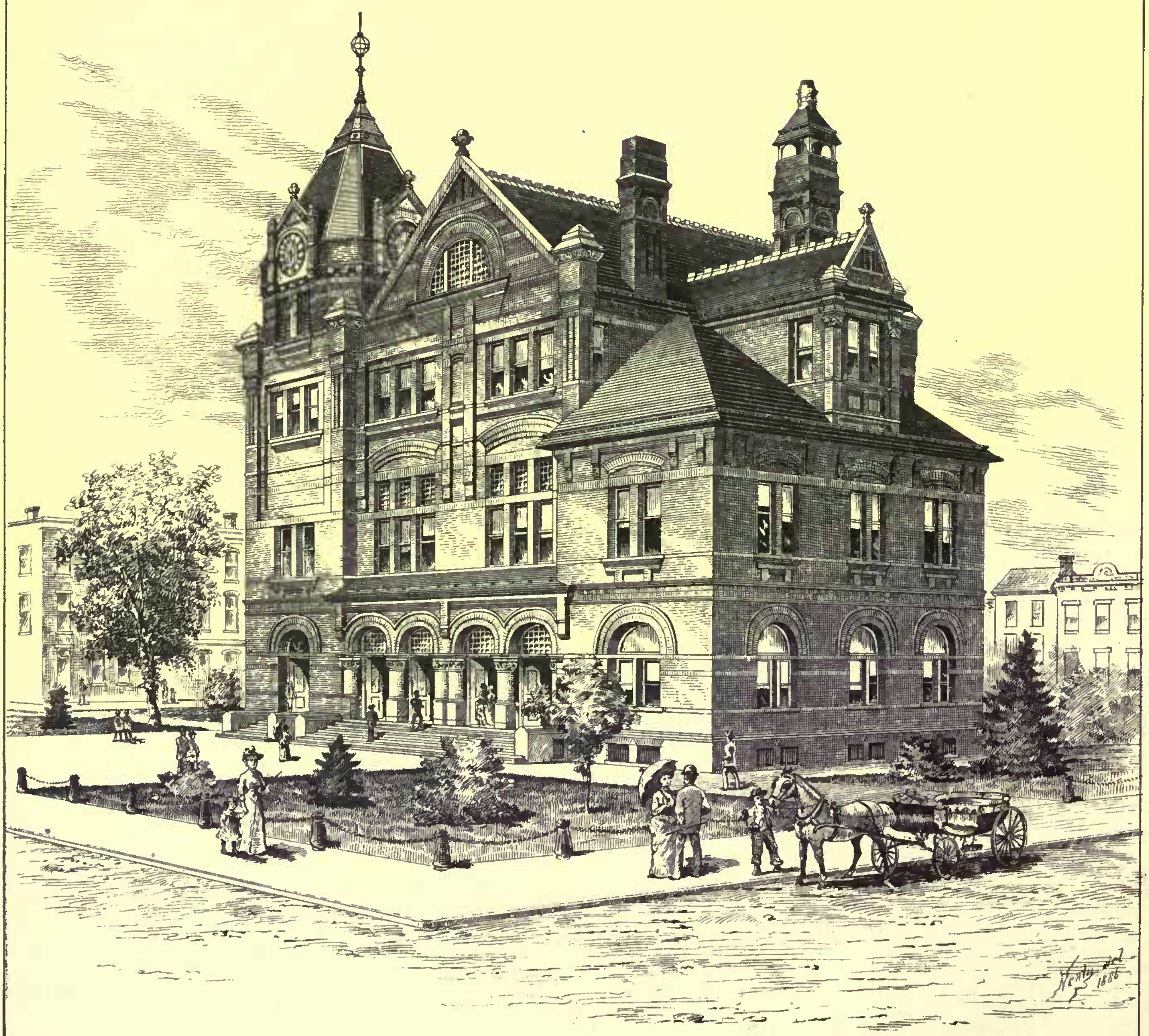
Beginning with the permanent collection at South Kensington, I examined the water-color drawings seriatim, stopping here and there to note down such observations upon particular works as seemed to bear upon the question of exposure. . . .



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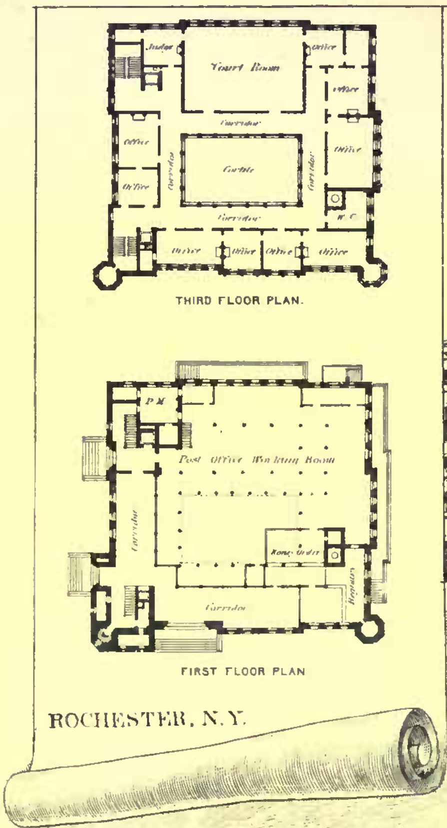
SECOND FLOOR



U.S. Court House, Post Office &c Carson City, Nev.

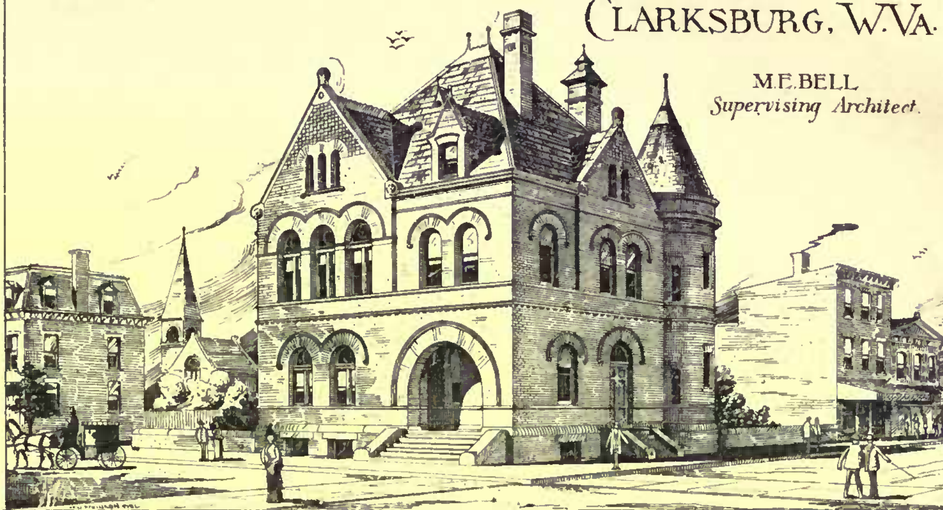
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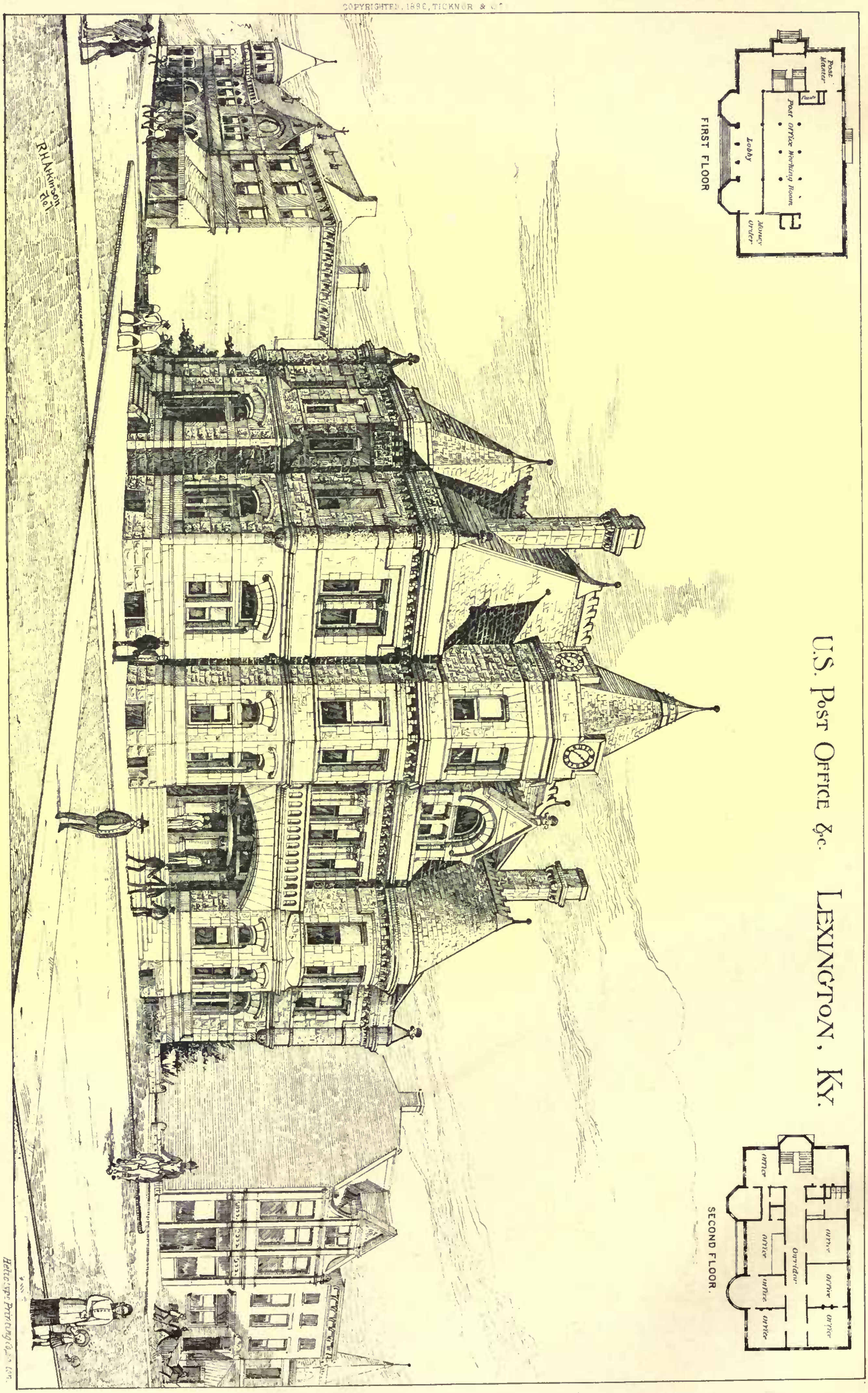


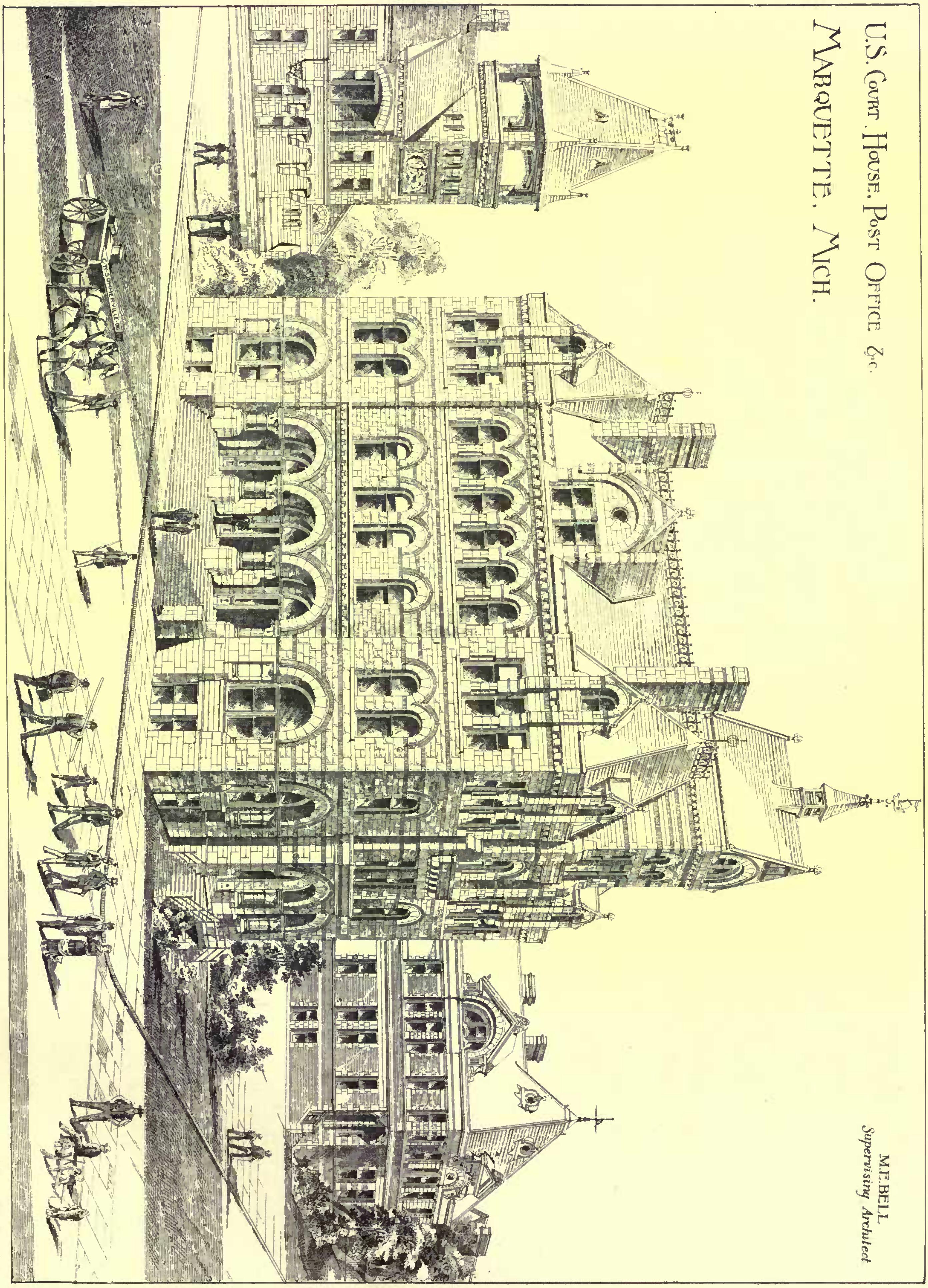


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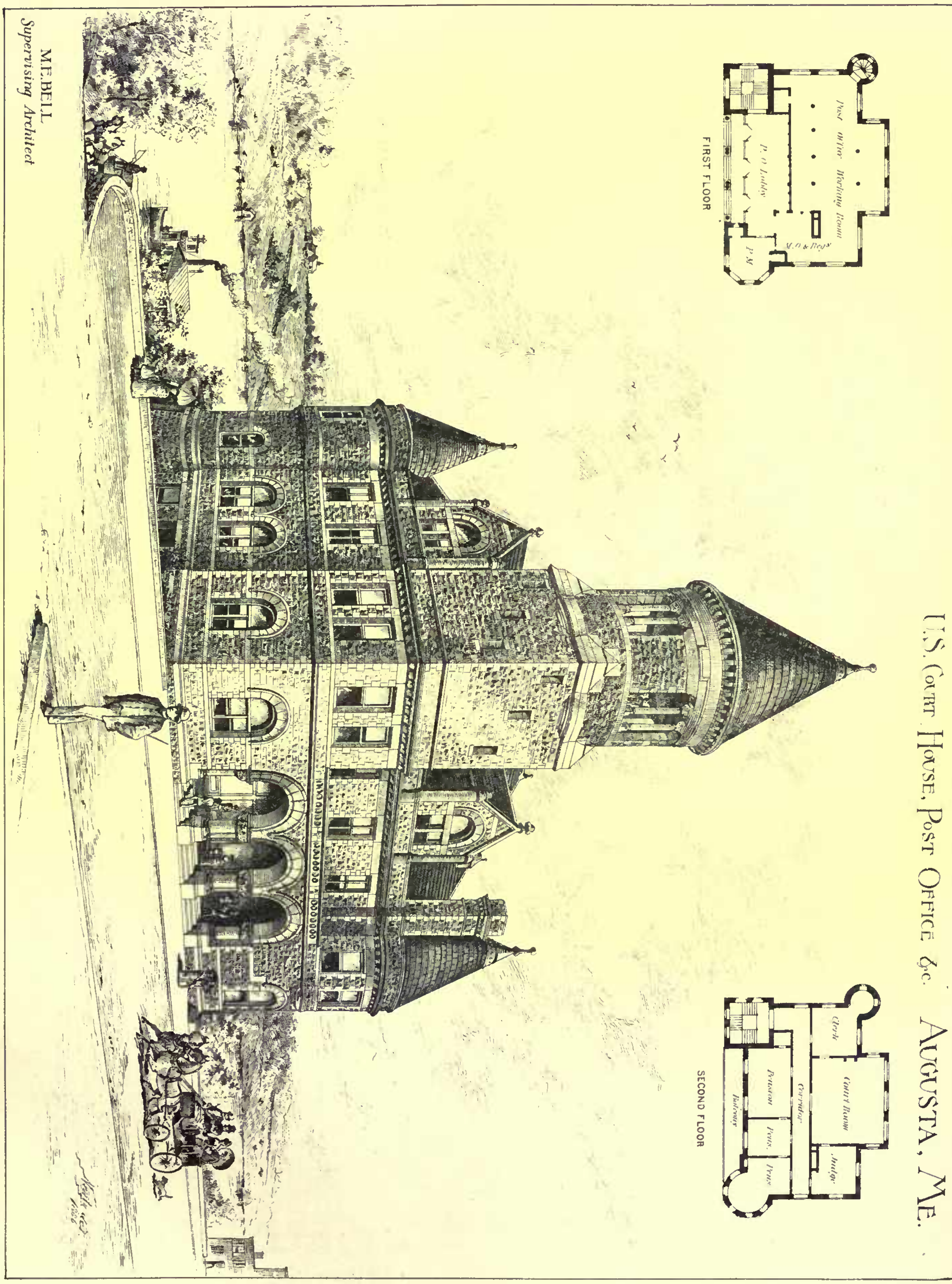
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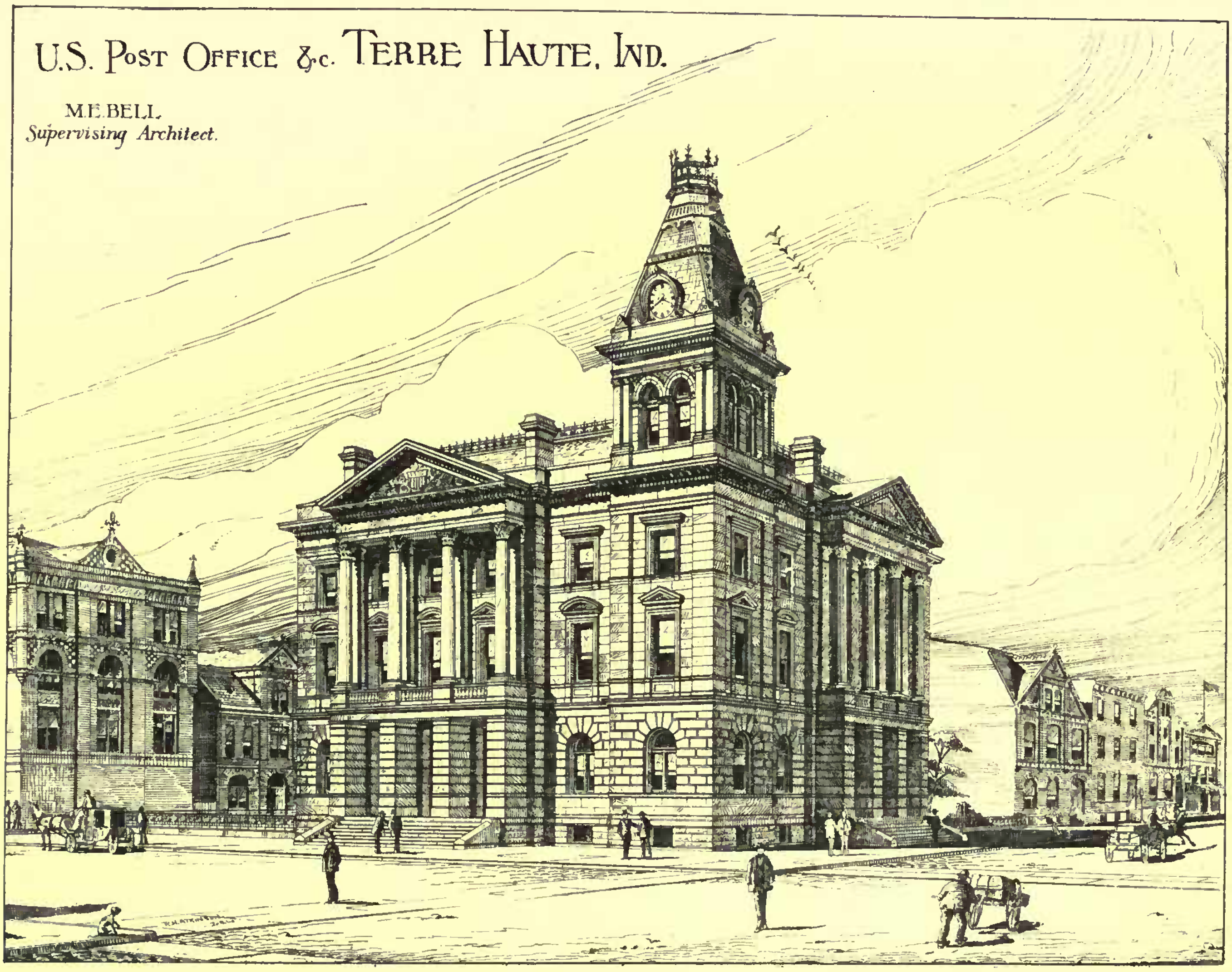
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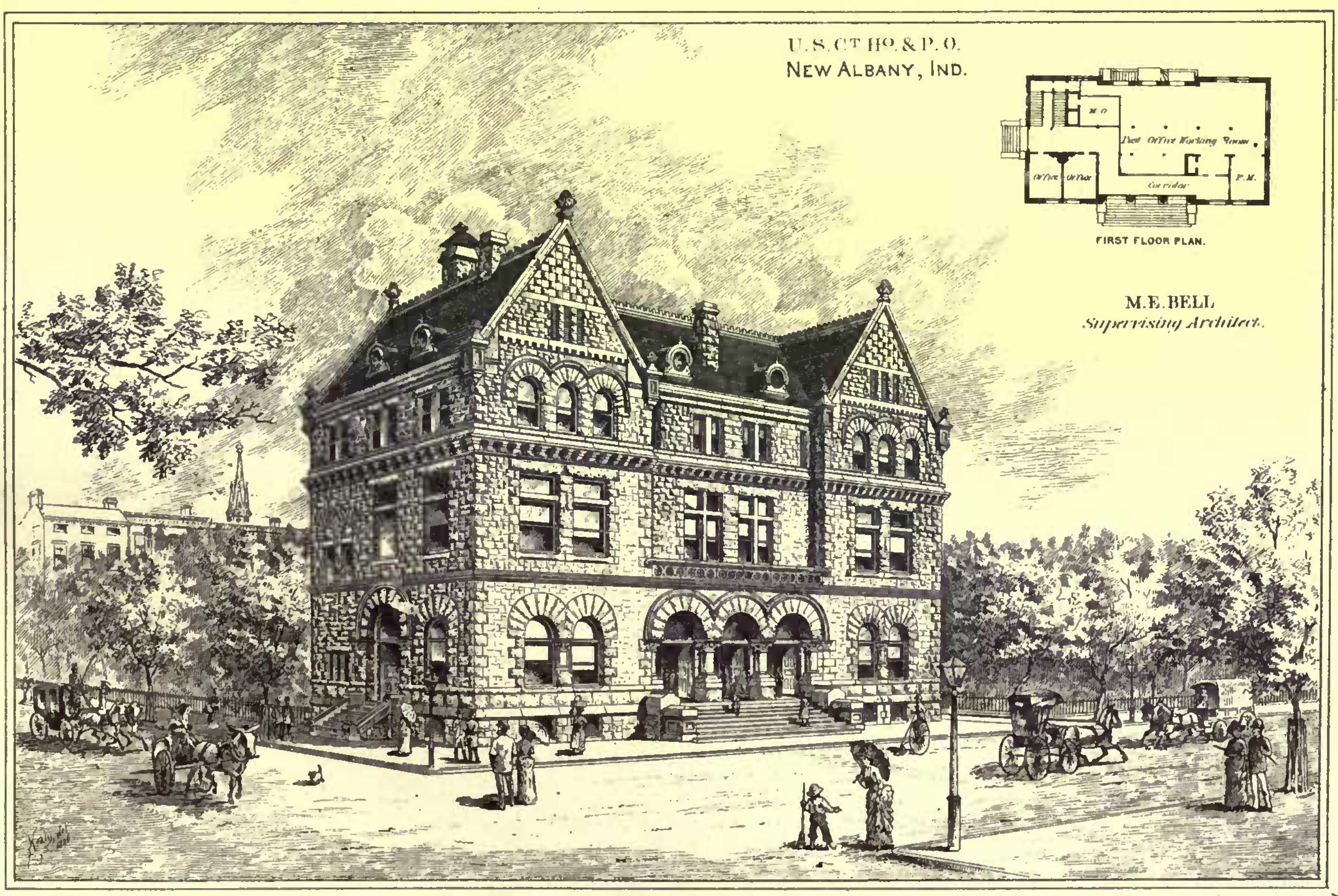
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U.S. Court House, Post Office &c.
Augusta, Me.
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P.O. Lobby
Post Office Working Room
SECOND FLOOR
Court Room
Clerk
Judge
Corridor
M.E. BELL
Supervising Architect
Heliotype Printing Co. Boston.



U.S. POST OFFICE &c. TERRE HAUTE, IND.

M.E. BELL,
Supervising Architect.



U.S. CT. Ho. & P.O.
NEW ALBANY, IND.

M.E. BELL
Supervising Architect.

The drawings by Turner, fourteen in number, are thoroughly representative of his different styles, and with the exception of "Hornby Castle" (No. 88), the distance and foliage of which seem to have slightly faded, are in excellent preservation. The "Warkworth Castle" (No. 547), exhibited in 1799, is a splendid example of permanence. The paper in this beautiful drawing — perhaps slightly deepened in color by age — seems to justify the assertion of Sir James Linton that this work and some others that he mentions are actually deeper in tone than when they were first painted — a remark that has been perverted by Mr. Robinson into the assertion that they have gained in *brilliancy*.

Three drawings by H. W. Williams, who died in 1822, come next on my list — No. 648, "Castle Campbell," No. 649, "Loch Tummel," and No. 3018, "Bothwell Castle," painted in 1802. All three in perfect condition.

Francia, who died 1839, Nos. 568 and 625, the first faded, the second unchanged. The works of this clever artist are grey in tone, which renders it somewhat difficult to give an opinion as to what their antecedent condition may have been. The same remark applies to many of the earlier masters. John Glover, born 1767, died 1849, No. 478, "Tivoli," apparently unchanged. J. Laporte, *b.* 1769, *d.* 1839, "Conway Castle," sky and water much faded, the Indian red pronouncing itself strongly, the indigo nearly disappearing. I wish to insist upon this quality in indigo when it is associated with Indian red, because in a great number of cases this combination of pigments appears to have been the *sole cause* of fading.

Mr. J. C. Robinson, in his letter to the *Times* of March 26, makes the remark that "the more or less fugitive colors are not only by far the most numerous, but they are also the most brilliant and useful to the artist." Now here I must join issue entirely with Mr. Robinson, for, if we eliminate indigo and some of the vegetable yellows, the causes of decay are quite sufficient to justify the cry that "every fully-colored water-color drawing, framed and exposed to the light, begins to fade and change, to die in fact, from the very moment it is exposed. . . .

I now approach a series of drawings which offer a remarkable proof of permanence. I allude to the "Ellison Gift." It happens, most fortunately for my argument, that the greater part of these drawings are in their original frames. A glance at the style and condition of these frames ought to convince the most sceptical that the works they contain have been exposed on the walls for a period far exceeding the limits assigned by Mr. Robinson to the duration of a water-color drawing. . . .

Leaving this valuable series of drawing in the Ellison Gift, I will proceed to notice some others which have been selected to illustrate both permanence and change. And here I occupy more uncertain ground, as, for obvious reasons, I am prevented from ascertaining with certainty the extent to which they may have been exposed to light previous to their acquisition by the Museum.

No. 431, Cristall, *b.* 1767, *d.* 1847, "The Fishmarket, Hastings." This drawing shows no evidence of fading, but its appearance suggests that it must have been exposed to smoke or impure air long prior to its purchase by the Museum in 1873. No. 2938, Smith bequest, Eddridge, "Near Bromley, Kent," secured by the Museum according to the terms of the bequest in 1876; generally in good condition, as are the other eleven drawings by that artist. Eddridge was born 1769, and died in 1821. No. 1426, Townshend bequest, Robson, *b.* 1790, *d.* 1833, "Loch Coruisk, Skye," in perfect condition. No. 3047, Smith bequest, Bonington, *b.* 1801, *d.* 1828, "Street in Verona," in good condition. Nos. 568 and 569, J. Chalon, *b.* 1778, *d.* 1860. Both these drawings are in a bad condition. The "Welsh Landscape" has suffered from damp, and in the "River Scene" there is distinct evidence that water has run down it from above.

No. 3013, Smith bequest (1876), Cotman, *b.* 1782, *d.* 1842, "Dieppe." The color is unaltered, but there are mildew spots in the sky, pointing to damp. The other drawings by this artist are in good condition. No. 564, D. Cox, "Cottage near Norwood," in perfect condition. No. 158, D. Cox, "Moorland Scene," signed and dated 1854, quite unchanged. I have omitted to notice two other drawings in the Ellison Gift, which I here add to that important series — namely, No. 1011, J. Barret, "Landscape Composition," original frame, and No. 1012, J. Barret, "Weary Trampers," signed and dated 1840, both in a perfect state.

In order to justify the censure directed against the authorities of the Museum by Mr. J. C. Robinson for neglecting the necessary precautions for securing the safety of this collection, it will be necessary for that gentleman to prove that the unsatisfactory condition of some of the drawings, which I have not hesitated to notice above, has been brought about since they have been placed upon the walls of the South Kensington Museum.

It now remains for me to notice the interesting series of drawings by Cozens, included in the Dice collection. As regards their present condition they speak for themselves. I see no evidences of change, but they offer a valuable illustration of the method of work adopted by the early school of English water-color painters, being executed first in monochrone and then heightened in effect by thin washes of local color. This conventional treatment was followed by Turner in his early works, which in many instances have been actually copied from drawings by Cozens. Turner, however, very soon emancipated himself from the trammels of his instructor, his instinct for color leading him to see that one monotonous tint was quite inadequate to express the varied hues of shadows as seen in nature. Girtin shared with Turner in this just discrimination, and, even in the few years of life allotted to him, was able to effect a revolution in the practice of water-color art. The seven drawings at South Kensington appear to be well preserved, but as the turning point in the history of English water-color art it is to be hoped that the authorities of the Museum will be able to enrich their collection by other and more striking examples.

Passing to the works of an artist belonging to a totally different school, I will next notice the large drawing by George Cattermole, the "Diet of Spiers." This work having been particularly alluded to as an instance of fading, I wish to ask why it is that other drawings by Cattermole belonging to the same series (the Ellison Gift) and exposed to light under the same conditions offer so marked a contrast. The answer to this question is very simple. The "Diet of Spiers" is a very early work of the master. It is executed on white paper in transparent color. At an early period of his career Cattermole discovered that the use of white paper was not congenial to him, and he soon abandoned it for the peculiar gray coarse paper used, I believe, for wrappers by the papermakers. Upon this material he painted frankly in body-color (*gouache*). This method, so well suited to the impetuosity which characterizes his work, he pursued to the last.

The drawing in question, regarded as a work of art, could never have competed with his later productions, but I have it upon the authority of one of Cattermole's most intimate friends — a gentleman still living, and who is the contributor of some of the finest productions of the master in the present exhibition at the Institute — that this particular drawing was allowed to remain uncovered for weeks together at the engraver's, exposed certainly to dust and possibly to damp.

The drawings by Holland may also be compared with advantage with those at the Institute, these latter being authenticated as having been for many years exposed to full daylight. I am unable to discover any appreciable difference between the works of this artist as represented at the South Kensington Museum and those now on view at the Institute.

I will close the notice of the South Kensington drawings, necessarily imperfect, by a reference to a work by Wm. Hunt, because it has been cited by Mr. Church in evidence of fading under the treatment to which it has been subjected at the Museum. The drawing in question is obviously an unfinished one. This the pencil-marks still left in the background would suffice to show; but I would call attention particularly to the melon, the principal feature in the work. This portion of the drawing has not faded, for the color has never been there. It is simply a *laying-in* with body-color previous to its completion in transparent or glazing colors — a process familiar to oil painters, but seldom resorted to by water-color artists except in the case of William Hunt.

We come now to the region of facts, not only as regards the actual condition of some of the finest specimens of water-color art that have ever been gathered together, but also to that chief element in the question, the history and antecedents of a considerable number of them.

I allude to the collection at the Royal Institute which the energy and perseverance of Sir James Linton have enabled him to present to the public as a proof that the hasty and sweeping charges brought against one of the most beautiful arts of our time have not been substantiated and are incapable of verification.

Presuming that most of the readers of this article have personally inspected the collection in question and that the perusal of Sir James Linton's preface to the catalogue will have explained the objects of the exhibition, it will be sufficient to state briefly that it was intended to confute a mischievous fallacy which by its wide circulation through the medium of a powerful journal is calculated to mislead the public into the belief that one of the richest and purest enjoyments of our lives — the contemplation, namely, of the works of the greatest English water-color painters of a past generation — is a fleeting delight which can only be indulged in under conditions that are troublesome and difficult of attainment. Who can compare for a moment the satisfaction we derive from the inspection of works in a museum with the enjoyment of water-color drawings exposed upon our walls? The critic or dilettante visits the British Museum to compare styles or to verify a date, and it is well that this opportunity should be afforded him, but the pictures upon our walls appeal to a different and I think a higher faculty. Who is there that, being the fortunate possessor of beautiful works of art, will fail to admit their humanizing influence? and how the aspect of a "Turner" or a "David Cox" diverts his attention from the petty cares of life, the *res angustæ domi*, and even helps to soothe him under the pressure of greater troubles?

I would wish to point out that the objects of the permanent collection at South Kensington and the much smaller exhibition which I am now about to notice are widely different. The South Kensington Museum is above all an educational institution, and its art collections are brought together with the distinct intention of guiding the student in the investigation of the history of its different branches. Hence the condition and the qualities of individual specimens have been less regarded than the position they occupy in the category they are intended to illustrate. The exhibition of early English water-color painters at the Institute consists of the contributions of

various collectors and connoisseurs, who have kindly lent their works for the purpose indicated. In the former case I purposely selected for notice many of the drawings which at some period of their existence had suffered injury from the treatment to which they had been subjected, with the view of showing that in numerous cases other causes besides exposure to light had been at work. With regard to the Institute collection no such discrimination is required, for they are nearly all in admirable condition.

I will proceed to notice a few of these drawings. The three magnificent Turners, now the property of Professor Ruskin, occupy — as their transcendent beauty entitles them — a central place on the walls of the Council Room. Of the drawing No. 90, "Scene in Savoy," I am enabled to state with absolute certainty the following particulars. Professor Ruskin speaks of it in these terms: "It is a very early drawing, certainly not later than 1812 or 1814, and I cannot conceive of it as ever more beautiful than now." To my personal knowledge the "Scene in Savoy" was hung on the walls and exposed to ordinary daylight for upwards of twenty years. Mr. Ruskin proceeds to say: "The Devonport and Salisbury were hung in the excellent light of Mr. Windus's drawing-room at Tottenham, and came from Tottenham to Denmark Hill." No. 8, Turner, "Tintern Abbey," exposed to light ever since it was painted in the year 1800. The practice pursued by Professor Ruskin of covering up his Turner drawings during a portion of the day, although, as evidenced by the condition of many works by Turner, by no means a necessary precaution, is to be advocated as an exceptional measure, owing to the extreme tenuity of many of his tints and the subtle gradations of color upon which so much of the value of his work depends. It is well known that paper when excluded from the light acquires a yellow color by age, an effect similar to that produced upon oil pictures. It is, therefore, in every way desirable that delicately-tinted water-colors should be alternately covered over and exposed to light. The opinions of Professor Ruskin upon all matters relating to art stand in no need of advocacy by me. Every line that he has written will be remembered and quoted long after the present controversy has been forgotten; but as he has been charged with inconsistency, it is well to remember that he only advocates this precautionary measure in the case of drawings by Turner. . . .

I have now, I trust, succeeded in verifying my original statement that a very large number of the drawings in this remarkable collection have been exposed to full daylight without appreciable change. The publicity given to the statement of Mr. J. C. Robinson has induced me — I fear at the risk of wearying the reader — to go into much detail. This has been inevitable, for it is only by the reiteration of particular facts that it has been possible to meet general accusations. As regards the present condition of the drawings, they speak for themselves.

In a letter from Mr. J. C. Robinson recently addressed to *Truth* the following passage occurs: "What is there to show that many, perhaps even the majority, of these drawings may not, for the greater part of their time even, have been kept in the dark in portfolios, or otherwise carefully protected from the light? This has certainly been the case in some instances; and if this can be proved, is not the exhibition at least sailing under false colors?" I trust that the information I have been enabled to procure is a sufficient answer to these questions. Had the collection at the Institute consisted solely of works that had been exposed to daylight, Sir James Linton would have laid himself open to the charge of having purposely excluded every drawing which told against his argument. It might have been supposed that the mere fact of such a collection as this having been secured in *little more than a week* would have been sufficient to refute the absurd accusation that members of an honorable profession have banded themselves together in order to propagate a falsehood — for this in effect is the charge hurled against them.

Before concluding this branch of the subject, which is intentionally devoted to the enumeration of facts, I wish to call attention to the condition of a small but well-selected collection of drawings in the possession of my friend, Mr. Henry Drake, of Kensington. This gentleman has not only afforded me an opportunity of carefully inspecting the works in question, but has given me the assurance that they have been hung on his walls for twenty years, and for about the same time on the walls of their former possessor. Being most of them in their original frames, it may be taken for granted that they have been exposed to light for more than forty years. I think that their present appearance would be a revelation to those who hold that the period of thirty years arbitrarily fixed upon for the duration of their existence so far as color is concerned, has been far exceeded. The collection comprises drawings by the following artists: W. Muller, Copley Fielding, David Cox, G. Cattermole, E. Duncan, G. Fripp, P. Naftel, and others, all in admirable preservation. No special precaution has been adopted with regard to these drawings, except their protection from *direct* sunshine.

The difference between the effects of direct sunshine and diffused light are so enormous that I was long under the impression that they differed in *kind* as well as in degree. The inquiries I have instituted concerning this matter have led me to modify this opinion, but practically my conviction remains the same, and I think the above facts attest that there is a gulf between the effects of sunshine and ordinary diffused daylight — an assertion that no one who has practically studied the subject will be able to deny. The exclusion of the direct rays of the sun from water-color drawing is a condition of their preservation in the state in which they were produced; and had the discussion opened with a recommendation to that effect, I am convinced that the controversy would have been pursued in a very different tone from that it has unfortunately assumed.

It is to be observed that in his first letter to the *Times* Mr. J. C. Robinson takes no notice of the varied pigments employed by different artists, but pointedly asserts that *all* water-color drawings are doomed to destruction unless guarded from daylight, thus leading the uninitiated reader to conclude that *all* the pigments employed by water-color painters were open to the same objection. It was not until Professor Church took up the question and pointed out the particular pigments that should be used with caution, that Mr. Robinson descended from vague generalities to the consideration of really important factors in the question. It is, however, worthy of remark that Mr. Church is more exercised in his praiseworthy endeavors to promote the study of the chemistry of pigments among living artists than in vain regrets over the ignorance or indifference of some of the greatest artists of the century concerning the pigments they employed.

The greatest master of landscape painting — the man who occupies a solitary pedestal in Walhalla of landscape art — was admittedly careless in this respect. In whichever medium he worked, the one consideration by which he seemed to be guided was the production of the effect to which he was urged by the inspiration of the moment, and this especially with regard to the scheme of color he adopted, which induced him to select the colors which were the best exponents of his ideas. Turner was probably little troubled by the question of durability. As Mr. Ruskin happily remarked, "He feels in color, but he thinks in light and shade." The rich enjoyment which the mere practice of his art must have afforded him was untempered by anxiety as to the future of his work, and was akin to the satisfaction of a great musician who draws sweet tones from his instrument.

It is from these considerations that I should feel disposed to exclude the water-color works of Turner from the walls of our public galleries, except under the conditions which in the National Gallery render them secure from injury.

Passing on to the lesser lights, the men who, admirable in their way, are only second to Turner, it would be a misfortune were we to be deprived of free access to their works so long as they are placed under vigilant care.

The pessimists, happily few in number, would have us believe that the durability of pigments, as regards the effect of daylight upon them, is in the inverse ratio of their usefulness. This is fortunately far from being the case. The fading effect of light upon certain pigments is almost confined to those of organic origin, many of which have been but sparingly employed by our best water-color painters.

Sir James Linton expresses the opinion that certain drawings have even become richer and deeper in tone than when they were first painted, but he is represented by Mr. J. C. Robinson to have said that they have gained in *brilliancy*, which is quite another thing. The desiccation of the size in the paper, as well as the gum and other media employed in the manufacture of water-colors, may have conduced to this quality, a change which is analogous to the darkening of the oils and varnishes in oil paintings.

It has been hinted that artists are not entitled to a hearing on this question of durability, on the ground that they are influenced by interested motives. The truth or fallacy of this accusation must depend upon the meaning attached to the word. In one sense artists are certainly *interested* witnesses, but if sordid motives are attributed to them such an imputation must be emphatically disclaimed. Mr. Robinson may rest assured that the sincerest admirers of the early school of English water-color painters are to be found in the ranks of living artists, who would view with dismay the dissolution or decay of the priceless treasures which have been bequeathed to us.

Many artists have themselves instituted experiments upon the pigments employed by painters in both materials, but they have hitherto been of a desultory nature, and not pursued with sufficient system. The investigations of Professor Church have been of great value in this respect, and whilst deprecating the animus exhibited by Mr. J. C. Robinson, both as to the matter and the manner of his attacks, I am quite ready to allow that good results may follow from the inquiry that he has instigated, and whilst separating the good seed from the chaff let us remember the old adage: *Fas est et ab hoste doceri.*

Before this controversy began, people were becoming weaned from the fallacious doctrine that works executed in water-color were necessarily less permanent than those "protected" by the oils and varnishes with which they were painted, and it is to be hoped that this scare will not deter them from reconsidering the verdict that all water-color drawings which have been long exposed to daylight have been irreparably injured.

Mr. Robinson contends that one of the causes of the greater stability of oil paintings is the circumstance that the pigments are employed in far greater volume than in water-color painting, strangely overlooking the fact that the early painters applied the colors with remarkable thinness, as may be seen in the works of Jan van Eyck, Albrecht Dürer, Holbein, and in most of the early Italian masters. It is moreover to be noticed that these works were

painted on a white *gesso* ground, and probably in water-color. The use of oil or varnish was an after-process employed in finishing the picture. I am aware that I am now treading upon debatable ground, but there is high authority for the assumption. Now these so-called oil paintings are precisely the works which excite the admiration of the world not only from their inherent beauty, but from their extraordinary durability.

The practice of loading the color belongs to a later date, and I have yet to learn that it conduces to their permanence. That light is not without its influence upon certain pigments, even when they are "locked up" by oil or varnish, is evidenced by the fact that numerous examples of the Dutch school have suffered in this respect.

Landscapes by Hobbema, Both, and Ruysdael, frequently show fading in the greens of their foliage. In these cases yellow glazing colors of vegetable origin have been employed, which, being fleeting, have passed away, leaving a cold blue green underneath. Such examples might be multiplied, and they extend even to the Florentine and Sienese schools of the fifteenth century, and especially in the flesh tints of Botticelli, whose works, graceful and refined as they must always have been, may even have acquired a certain pathos from the pallor that has ensued owing to the use of pigments prepared from cochineal.

I mention this fact in order to show that the fading effects of light upon certain pigments is by no means confined to water-colors. On the other hand, the durability of flax, which material is the foundation of all good drawing paper, is abundantly proved by the wonderful preservation of linen in the Egyptian tombs.

"Pure old water-color painting upon pure old rags" — such is the panacea offered by the greatest art critic of the day, to pour balm into the wounds of those who hold that all water-color drawings are doomed to extinction when exposed to daylight.

In the opening pages of Mr. J. C. Robinson's article in this *Review*, to which I have presumed to offer a reply, he says that in his first communication to the *Times* he did not intend to provoke a controversy, by which, I suppose, he means that, the fiat having gone forth that all water-color drawings were for the future to be considered as inherently perishable, it would be presumptuous for any one to dispute either the premises with which he starts, or the conclusions at which he arrives.

Not being in a position to speak *ex cathedrā*, and having to face the proverbial difficulty of proving a negative, I have ventured to embark in a controversy with an assailant in whom fluency and wealth of illustration are happily blended. But, fortunately for ourselves, combatants have been enlisted on our side who combine a practical experience of the art in which they excel with the critical faculty which renders their testimony of the highest value. As any definitive judgment upon the merits of the case can hardly yet be expected, we must look to the gradual enlightenment of the public for the decision of a question that concerns every lover of art.— *Frank Dillon in the Nineteenth Century.*

SPIRES.



THE LORD MAYOR'S CARRIAGE
REVUE DES ARTS DECORATIFS

THE tall spire, conveying to the mind an idea of immeasurable height, and seeming to fade away in a point, is, perhaps, the most perfectly beautiful external feature of the Pointed or Christian styles of architecture to which it properly belongs. In all ages and countries there has been an apparent tendency to carry buildings to as great a height as possible, and hence have originated the various architectural forms of pyramids and obelisks, towers in endless variety, domes of various shapes — Classic, Byzantine and Saracenic — the minarets of the East, and tall monumental pillars; but the spire, obvious as its form seems in its pure simplicity, was unknown in architecture until towards the end of the eleventh century. There have been many discussions, somewhat unprofitable, though interesting, as to the source whence the mediæval builders drew their first ideas of the pointed arch and spire, and general opinion has apparently settled to the conclusion that the pointed arch was simultaneously suggested to the various nations of Europe by the sight of the Saracenic arch during the Crusades. If this were really so, it must be added that the genius of the Christian builders improved so vastly upon any hints they may have received from the East that all traces of such origin rapidly disappeared. The spire, however, is a purely self-evolved feature, which originated in the general tendency of Pointed architecture, completely independent of external hints or examples. Among other suppositions, it has been said that the form of the spire might have been suggested by the pyramids or obelisks of Egypt; but there are so many points of dissimilarity between these objects and the true spire that it is extremely unlikely. It is usual to refer to the pyramidal covering of the tower of Thaon Church in Normandy, built towards the end of the eleventh century, as the earliest example of a spire, but it is hardly correct to call this a spire at all. It is neither more nor less than a small pyramid, square in plan and with sides formed of four equilateral triangles, the stones of the interior being left rough, and overhanging each other. There are several pyramidal roof coverings of a like nature, erected about the same date in Normandy, and incorrectly spoken of as early examples of the spire; but the true spire was not developed until the square plan, which is of the essence of the pyramidal form, was abandoned.

Early native Indian architecture made some approach to the form of the spire, but never actually reached it. The typical Indian temple was a cubical building of small dimensions, and some temples at Benares have roofs which rise to a great height compared with the building, and have a straight outline tapering to a point. Others, as in Orissa and elsewhere, are varied in shape by projections on the plan, and are covered with a lofty roof which follows the plan of the building to its apex, which it reaches with a considerable outward curve. We also meet with pinnacles and other ornaments on these lofty roofs, somewhat resembling those applied to the spires of Christian art, but none of them can properly be called spires. The tall *gopuras*, or gateways of Southern India — which our forefathers used to call pagodas — are, properly speaking, towers which diminish in size as they ascend, and although of slightly tapering form have no affinity with spires. The utmost that can be said of the spire in Indian architecture is that it received a very imperfect development, if any; but even this there is no historical reason for supposing that those who built the first Christian spires ever saw, or had the least knowledge of.

The pyramidal roofs above named, combined with the pointed terminals, often employed on buttresses and turrets in the Later Norman and Early Pointed styles, were the immediate precursors of the spire, and its form was probably suggested by them, although Mr. Fergusson was of opinion that the spire took its origin from the gable termination seen in some foreign towers. They, however, generally corresponded in plan with the structures to which they gave a finish, and rose to no very great height. Thus the square towers had square pyramidal roofs, which rose direct from the outer surface of the walls, and, therefore, were without parapet or space around the base. They were also necessarily of very low proportions compared with the octagonal spires of later date, as may be seen in the Norman churches of Thaon, before mentioned; of Comornes, near Bayeux; of Basly, near Caen; and of Rosel. Circular turrets had circular spirelets or cones, and at Rochester Cathedral there is an octagonal turret, which has a small octagonal-pointed covering like an incipient spire. The square pyramidal roof had also an unavoidably heavy effect, with a too strongly-marked diversity of light and shade.

The true spire, however, received its finest development in England, and its introduction was coeval with the Early English or Lancet style. Its distinguishing characteristics are — its general octagon plan, the very acute angle to which it ascends, and the simplicity of its straight outline.

In the first stage of development of the Early English spire, it was still little more than a stone roof, like those of Normandy; the tower on which it was erected had no parapet, the spire came down with dripping eaves, and was supported on a corbel-table. There are very few spires remaining of this period, it having been most common to construct them of timber, which has perished long ago; although spires must have been very numerous, it being evident, from the construction, that nearly every tower of any importance was designed with a view to a spire of some kind, although to this rule there are exceptions in some districts — that of South Northamptonshire, to wit, where parapets and low roofs were placed on some small towers from the beginning. In some cases the stone spire, which afterwards replaced that of timber, retains the form of its original — namely, square at the base, though immediately becoming octagonal, so as to give the cardinal faces the appearance of being spread out in an awkward manner. This is the case at Etton, which has dripping eaves. At Aylstone and some other Leicestershire examples, the spire is connected with a sort of parapet; at Denford, Northamptonshire, with a parapet and pinnacles at the angles.

The name of the "broach spire," or as it is still called in some parts of England simply the "broach," is commonly given to this, the earliest class of spire in England. A broach spire springs directly from the eaves of the tower walls. It was at first entirely without parapets or gutters, being made simply by shaving off the corners of the tower at the top, and so creating an octagonal platform, with which the spire exactly corresponded, and from which it naturally ascended in its unadorned simplicity. Another kind was formed by chamfering the spire upwards from the corners of the tower; in other words, a square spire was placed on the tower, and its angles were shaved off from the apex to a point near the base, where the cutting was continued obliquely to the corners of the tower. But the genuine broach spire is octagonal from its base; the cardinal faces hang down over the eaves, and the intermediate faces are connected with the tower by conical *squinches* — *i.e.*, arches thrown across the corners within, and finished on the outside in a slope. On the proportions of these squinches, the effect of the spire in a great measure depends. An example of this spire, though of later date, is to be seen at Warmington Church, Northamptonshire; also at Wansford and Polebrook, Bampton and Witney in Oxfordshire, and at Bayeux Cathedral, St. Etienne at Caen, and many other places. At Witney and

at Oxford Cathedral are examples showing that pinnacles may be very well combined with a broach spire, either with or without turrets at the corners of the tower. As the geometrical styles advanced, spires became more lofty, and lost much of their massiveness; the spire lights had less projection, the squinches became smaller, and frequently carried pinnacles.

In the Decorated period a great many broaches were still erected, but there were many instances of deviation from it; that is to say, there were many examples in which the cardinal faces did not spring directly from the walls of the tower. This change resulted in the spire becoming, so to speak, an incidental appendage to the tower, rather than an essential portion of it. Yet there was a feeling against allowing the spire to seem quite unconnected within the parapet. Squinches gave way to pinnacles, and, in many beautiful instances, to flying-buttresses. The spires became more acute and lofty, as they rose from an octagon formed in the roof of the tower instead of from the tower itself. The walls of the tower were terminated by a parapet; and an open space within was left round the base of the spire, which formed a gutter. In the triangular spaces formed at the corners pinnacles and clusters of pinnacles were placed, from the midst of which, in the finest examples, the spire itself rises, apparently, only the central and loftiest pinnacle among a forest of smaller ones.

St. Mary's, Oxford, affords a fine example of this clustered and pinnacled spire. It rises from the tower not like a roof, as the broach, nor yet like something altogether unconnected. The junction of the tower and spire is effected with inimitable skill, although neither, taken alone, is worthy of the mode of connection. Both are rather bare; but the pinnacles are of elaborate richness. The spire is utterly plain; but than the grand array of pinnacles, nothing could be nobler. Clustered pinnacles arise from the double buttresses; these support taller pinnacles between themselves and the base of the spire, and from the midst of them rises the spire itself. The spires of this period do not differ much from Early English, except in detail and enrichments. Besides crocketing and ribbing, there are frequently bands of panelling at various heights, and the openings are more enriched. One of the finest spires of this period, that at Salisbury, is the loftiest in England, rising to about 387 feet. The spire of Old St. Paul's Cathedral, which was completed in 1422, and destroyed in the great conflagration, was, however, the loftiest in Europe, having been 500 feet high. This was of timber, and covered with lead. Such spires are still common, the lead being lain on in flat sheets; others have lead in narrow strips, laid diagonally. Timber spires are also very common in Germany, and the northern countries of Europe, and are often disfigured by bulbous excresences, which do not originate from any consistent principle of construction, and greatly detract from the simple beauty of outline which ought to be the chief characteristic of the spire. To treat of only a portion of the eccentric forms to be found in German and Scandinavian spires, which are rendered possible by the facility of working in timber, would be too lengthy a task. A very instructive drawing of one, showing its unnecessarily complex construction, as contrasted with the simple stone spire, is to be found in Pugin's "*Principles of Pointed or Christian Architecture*" (page 8). Detailed drawings of the carpentry of timber spires are given in Viollet-le-Duc's "*Dictionnaire de l'Architecture Française*" s. v. "Flèche."

In the Perpendicular period the broach spire had not quite gone into disuse; but it was chiefly confined to the border-line between Northamptonshire and Leicestershire. In other places the spires followed the same general arrangements as previously, the variations being principally in style of decorations. There were, however, many varieties formed by combining, in various proportions, the peculiar features of preceding styles. Hence we have: (1) Spires with parapets, rising unconnectedly from within a battlement, with or without small pinnacles at the angles, or from various parts of the battlements, but without flying-buttresses. (2) Spires with flying-buttresses, from the angle pinnacles to the spire, which form the genuine and distinctive feature of the spire of the Perpendicular period. A most beautiful example is afforded by the spire of St. James's, Louth, Lincolnshire. Others occur at Rushden, Thaxted, Moulton, Whittlesea, Cambs, Hanslope, Bucks, King's Sutton, and many other places. (3) Spires set on octagons. This form became common in the Perpendicular period. Sometimes the tower is itself the octagon, but more frequently the octagon merely forms an intermediate stage between the square tower and the spire, by which the various methods of joining the square and octagon are transferred from the spire itself to the two portions of the tower. The result is not quite pleasing; the octagon appears a less satisfactory support than the broader mass of the square tower, and it often seems as if the lower part of the spire had been shaved down vertically. The finest example of this kind is to be seen in the Church of St. Michael, Coventry; but in looking at it, and at most others of the same class, one can hardly avoid the idea, that the octagon is taken out of the height of the spire. Other examples, to which the same remarks apply, are at Exton, Rutlandshire, and at Wilby, Northamptonshire. (4) Flying spires. Of these there are very few examples; the best known is at St. Nicholas, Newcastle-on-Tyne, where a sort of crown is supported in the air over the tower. Enormous angle turrets, with spirelets, support huge flying-buttresses, and these bear aloft a small square tower, which has its own parapet and pinnacles, connected by flying-buttresses, with a small octagonal spire. The ingenuity of construction is something marvellous; but the difficulty of carrying it out must have been enormous. Sir Christopher Wren imitated this in the steeple of St. Dunstan's-in-the-East, London. Others of the same class are at St. Giles, Edinburgh, at Linlithgow, and at Aberdeen.

The technical construction of the spire is a subject of great interest, but requires treatment at greater length than could be given in this article. — *Building News.*

THE SEVERN TUNNEL.



FROM OLD HOUSE AT BERNAY, FRANCE.

WITHIN a few days of twelve months ago the railway tunnel constructed by the Great Western Railway Company under the river Severn was completed and informally opened by an experimental train being successfully run through. A few months later a goods train travelled through from Aberdare to Southampton, but even then the tunnel throughout was not ready for general service. Much more had to be done in regard to absolute pumping and ventilating machinery, and the completion of other extensions of the line in connection with the tunnel. Since January this work has been energetically prosecuted, and at last, on Wednesday, September 1, this important addition to the company's system is to be opened — only, however, for goods, for something yet remains to be executed before passenger trains can be introduced, but even for goods alone the tunnel will be of great value. Compared with such gigantic works as the St. Gothard Tunnel, nine and one-fourth miles long, the Mont Cenis Tunnel, seven and one-half miles long, and the Arlberg Tunnel, six and one-half miles long, this Severn Tunnel may perhaps be considered a small affair, but it is four and one-half miles long altogether, and it is the longest subaqueous way yet made. It is also the longest tunnel in England, and its construction has been attended by circumstances of difficulty peculiar to cuttings under water, such as are not experienced in the boring of land subways. In the latter operation there may be, and often have been, serious obstacles to overcome owing to the nature of the material to be penetrated, and in some cases springs have been tapped, which caused inconvenience; but the quantity of water was not very great and was easily withdrawn, and powerful drilling-machinery has been employed to pierce the rock. In tunnelling beneath a wide river there have to be faced not only the ordinary conditions of strata and underground springs, but also the risks of an inflow of the stream above. This danger was happily not realized in the construction of the Mersey Tunnel, but that tunnel runs for only a mile under the water, and the river at that point is, as a rule, comparatively calm. The Severn undertaking, however, presents a very different story. At the point chosen for the tunnel the river is two and one-fourth miles wide, and this estuary is described as more ocean-like than that of any ordinary English river. Moreover, it is characterized by rocks of a dangerous and solid nature, and there is a difference of as much as sixty feet between high and low tide. These circumstances would not necessarily cause an incursion of water, but, as a matter of fact, the construction of the tunnel was several times stopped, and the whole undertaking jeopardized both by river and land water. Considering the impediments that have had to be overcome, together with the period occupied, the execution of this work may rightly be regarded as a great feat of engineering skill, and the opening of the tunnel for actual, though partial public service, is an event of real importance.

When the great Western system was carried on to Bristol by Mr. Brunel, the intention was to connect it with South Wales by a steam ferry, capable of carrying across the Severn, not only passengers, but even loaded goods trucks. Subsequently, however, it was found that only a passenger ferry would be practicable, and consequently up to the present the goods and minerals have had to be taken by a circuitous route in order to cross by a railway bridge. Powers to make this tunnel were sought as far back as 1864, but the attempt failed then, as did likewise a second effort in 1870. In 1872, however, an Act was obtained, and the company straightway proceeded with the enterprise. Several shafts were sunk on both sides of the river, and the works were carried on from each end. An experimental heading, about seven feet high by seven feet wide, was driven through, and good progress was made. In October, 1879, however, when the two headings were within one hundred and twenty or one hundred and thirty yards of meeting, the heading under the Monmouth shore tapped a big fresh-water spring, and in twenty-four hours that half of the work was flooded. Up to that time Mr. T. Richardson was the engineer conducting the work, Mr. (now Sir

John) Hawkshaw acting as consulting engineer, but after this disaster Mr. Hawkshaw became engineer-in-chief, with Mr. Richardson as coadjutor. Upon his advice the bottom level of the tunnel was lowered by fifteen feet, and in other ways the original design was altered; the company also transferred the work of construction by contract to Mr. J. A. Walker.

Two brick dams of enormous strength and great thickness were built across the heading down which the water had flowed in, and thus further approach to the shafts and works under the Severn was prevented. Powerful pumping-engines were then set to work, and by the end of the year the water was withdrawn and excavation could be resumed. During the operations of clearing the works a very difficult and dangerous task was accomplished by a diver named Lambert. At a distance of one thousand feet from the bottom of the Sudbrook shaft there was a door, which required closing across the drift under the river. Assuming a Fleuss diving-dress, and carrying a heavy crowbar, Lambert descended the shaft, made his way toilfully through the flooded heading to the door, and succeeded in shutting it. This was, however, only managed with extreme difficulty and the exercise of great strength, for the door had got stiff on its hinges, and the diver was under water nearly an hour and a half. The clearance being at length effected, the work was carried on vigorously, and by the autumn of 1881 the two headings met, and a through passage was obtained. Prior to this, however, viz., in April, 1881, a slight but troublesome mishap had occurred. While the brickwork from the sea-walls shaft was being completed, a hole ten feet across was found in the marl near the Gloucestershire shores, and through this the water again rushed in too strongly for the pumps. By the use of clay-puddle the hole was filled up, and the pumps cleared out the water. By the autumn, as we have said, the junction between the two cuttings was effected, and all went on well until October, 1883, when another catastrophe took place, by which the whole work was again threatened with destruction. As mentioned already, the level of the tunnel was lowered after the first flooding, and while the men were at work in these lower levels, on October 18, 1883, the spring, which had burst through in 1879, was again tapped, and the water rushed in in enormous volume. The inflow was estimated at 27,000 gallons a minute, and very soon a considerable portion of the completed work was flooded. Once more the diver Lambert came to the rescue, but this time with assistants. Again a door had to be reached and closed, five hundred feet from the bottom of the shaft. Placing one assistant at the foot of the shaft, and another two hundred and fifty feet forward, with the air-tube, he made his way to the door, and, as before, succeeded. Meanwhile the pumps had checked the flood, and additional pumps being laid on, the tunnel was cleared in about a fortnight. So far, the two most serious interruptions had come from the fresh-water spring, but the contractors had yet to deal with an inroad from the river. On one occasion a huge tidal wave flooded a portion of the workings, but this was soon dealt with, and to guard against a repetition, flood banks were eventually erected with a height of five feet above the highest flood known. All these obstacles at last surmounted, the work was hastened on, and in October, 1884, the chairman of the committee, Sir D. Gooch, was able to pass through from the English to the Welsh heading. A year later the first train went through; after September 1, goods and mineral traffic will be established, and probably within three or four months, after some completing operations have been effected, the whole of the new system will be available also for passengers. The total length of the tunnel is 7,664 yards, or, say, nearly four and one-half miles, and to these the open approaches add something like the same distance. The height of the tunnel is twenty feet from the rails, with a width of twenty feet. In the deep parts of the work the tunnel is lined with Staffordshire and other vitrified bricks set in cement, three feet thick, but as it rises the thickness is gradually reduced to two and one-fourth feet. The water, at what is called the "shoots," is thirty-three feet at low water, and ninety-one feet at high water, and at this point the tunnel has a covering of forty-five feet, though under the depression called the "salmon pool" there is a covering of only thirty feet. On the Gloucestershire side the gradient is one in one hundred down to the lowest point under the "shoots," whence it rises one in ninety, the heaviest loads being expected from Wales. With a view to the drainage, a culvert five feet in diameter is provided, falling from the lowest point in the tunnel to the Sudbrook shaft. The water entering the works in the open cuttings will be intercepted at either mouth of the tunnel, and there pumped at the higher level, in order to reduce to a minimum the pumping at the Sudbrook shaft. It is believed that the pumping may be reduced to 5,000 gallons a minute, but unless the plan has been recently changed, permanent machinery is or will be provided, capable of four times that amount of pumping. Equally powerful and adequate ventilating apparatus is also provided. Altogether eleven shafts have been sunk — three on the English side, eight on the Monmouthshire side; and between 70,000,000 and 80,000,000 bricks have been consumed. Over 700,000 cubic yards of excavation has been accomplished, and, during one month, as many as four hundred yards were tunnelled. More than a mile of the tunnel was cut through the Pennant sandstone of the coal measure; half a mile through conglomerate overlying the Pennant, half a mile through shale of the coal-measure with occasional beds of coal, one of which was a foot thick, and the remainder was through red marl of the new red sandstone.

Heretofore the railway journey from London to South Wales has been the roundabout route *viâ* Gloucester; but the tunnel is twelve miles lower down the Severn than the railway bridge, and passengers will now travel to Bristol, and thence through the tunnel. The distance between London and South Wales will be reduced by fifteen miles, and even between Bristol and South Wales the time occupied will be shortened by about an hour. As to the cost, by the time everything is done, it will probably approach two millions, the whole of which is borne by the Great Western Company.—*Engineering.*

COMMUNICATIONS

THE DURABILITY OF ROUGH-CAST WORK.

KANSAS CITY, MO., September 7, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you kindly inform me, through your journal, as to the durability of rough-cast plaster-work and plaster ornaments as used on exterior of buildings, and what effect the weather would have upon them where the extremes are experienced, such as in Kansas City? Respectfully, etc., WILLIS J. POLK.

[ROUGH-CAST, properly tempered and carefully applied, will stand our changeful climate satisfactorily. At least, we used to be familiar with a house about one hundred years old whose external coat of rough-cast was in good repair, and the house dry and well preserved. Rough-cast used in small panels on the pseudo half-timbered houses just now in vogue is rather difficult to make tight at the joints; but in broad surfaces we believe it would give reasonable satisfaction.— EDS. AMERICAN ARCHITECT.]

A SIMPLE INTERMITTENT DISCHARGE FOR SUB-SOIL IRRIGATION.

DETROIT, MICH., September 8, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs,— I notice in Mr. T. M. Clark's "*Building Superintendence*" a description of the system of sub-soil irrigation, and page 207 shows a cut of cesspool with inlet and discharge pipes. I find in reading further concerning this system (which is practically unknown in this vicinity) that an *intermittent* discharge into the absorption drains is considered essential to permanent successful operation, and with a cesspool as above, I cannot see how the outlet pipes would ever become flushed, but the sewage would merely trickle through from time to time as the inlet discharged into the cesspool. Will you kindly give a description of an arrangement, automatic, if possible, by which the sewage could be discharged into the absorption drains *intermittently?* Respectfully, M. W.

[THE simplest form of intermittent discharge we know of is one we have used several times with success. It is obtained by dividing the cesspool into two portions, one the collector or ordinary cesspool, and the other a tight brick chamber, in which is hung a carefully-weighted tilting-pan, made of galvanized-iron and holding thirty gallons or so. The overflow-pipe leads from the large portion of the cesspool and discharges into the tilting-pan, which gradually fills, and, when full, tilts over and empties into the tight chamber in which it is hung. From the bottom of this chamber lead off the lines of open-jointed pipes, as may best suit the contour of the ground. The pan, when empty, at once swings back into place, ready to receive its next load. As the open-jointed pipe should be within one foot of the surface, a hill-side affords the best site for this kind of apparatus, though a level piece of ground can be used if it be possible to build the cesspool somewhat above the level of the ground, and protect it and the inlet-drain by grading-up about and over them. The level of the sewage in the cesspool proper has to be about two feet above the level of the outlets into the distributing drains.— EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

OLD PERSIAN PALACES AT SUSA.—A vast quantity of relics, the results of the excavations carried on for a long time on the site of ancient Susa by M. Dieulafoy and his companions, have arrived at the museum of the Louvre. They were brought to Toulon in a transport from Bassorah, and filled 215 chests, that weighed over 40,000 kilogrammes (nearly 40 tons.) The chief contents are: (1) Two fragments of a frieze of enamelled earthenware, adorned with lions in bas-relief, from the principal entrance to the palace of Artaxerxes Mnemon. Both fragments are over 13 feet high, by nearly 30 feet long; (2) a similar fragment of a frieze from the palace of King Darius Hystaspes, adorned with 12 figures of the loyal body-guard, the famous "Immortals." This piece is 11½ feet high, by nearly 40 feet long; (3) two fragments of a stair-case in same material; (4) two fragments of terra-cotta friezes, showing fantastic animals — they are together over 20 feet long by nearly six high; (5) the capital of a pillar from the palace of Artaxerxes, representing a two-headed monster — it is over 16 feet high by 13 feet in width; (6) a collection of cut gems, numbering about 300, which seem to date from the earliest period of the Sassanide dynasty; (7) a large number of arrow-headed inscriptions on stone or glazed earth, mostly from Susa; (8) a considerable collection of bronze coins from Susa and the neighboring districts, from the time of the Parthians and the Sassanides; (9) a quantity of bronze ornaments and mountings of the outer doors of the palace of Artaxerxes; (10) a number of statuettes of bronze, ivory, terra-cotta and marble, a quantity of vases and toilet ware; (11) a mass of objects of comparatively small value, enamelled Sassanide vases, Parthian urns for the dead, iron and bronze weapons, instruments, and skeletons. Beside these things, the expedition took plaster casts on a large scale of portions of the palace of Artaxerxes, also photographs of the neighborhood of Susa, the sites of the explorations of various old monuments and ruins in other parts of Persia. It is believed that five or six months will be required to get all the things in order. Diszful, the

modern village on the site of Susa, is about 400 kilometres from Bassorah. At first the expedition encountered much opposition from the natives, owing to a report that the Frenchmen wanted to carry away the body of the prophet Daniel, which is supposed to be buried in a cave in the neighborhood, a great object of pilgrimages.—*London Times.*

A Chinese Earthquake Detector.—In China there is a curious device to make record of earth tremors. One of the instruments is thus described: "It is of copper and is shaped like a wine bottle. Inside is a little pillar so placed as to move in eight directions. On the outside of the bottle are eight dragon heads, each of which contains a ball. Underneath these heads are eight frogs, so placed that they appear to watch the dragon's face, so that they are ready to receive the ball if it should be dropped. All the arrangements which cause the pillar when it moves to knock the ball out of the dragon's mouth are well hidden in the bottle. When an earthquake occurs and the bottle is shaken, the dragon instantly drops the ball, and the frog which receives it vibrates vigorously. Any one watching this instrument can easily distinguish earthquakes. Once upon a time a dragon dropped its ball without any earthquake, and the people therefore thought this instrument was of no use, but after two or three days a notice came saying that an earthquake had taken place in Rosei."—*Philadelphia Saturday Review.*

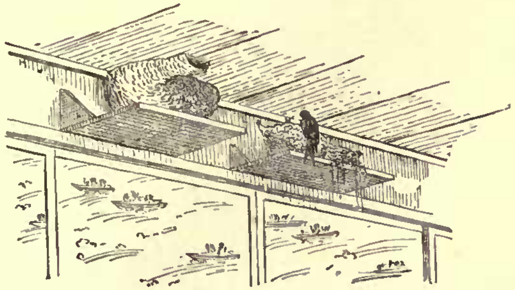
Lightning-Holes.—Professor Brun has published in the *Archives de Genève* an interesting study on the so-called lightning-holes to be found in the High Alps. He and other investigators have found them at heights of from 3,348 to 4,000 metres, or between 11,000 and 13,000 feet above the sea level. Usually they are found on summits. Sometimes the rocky mass, which has been vitrified in the passage of the electric fluid, presents the appearance of small scattered pearls, sometimes of a series of semi-spherical cavities only a few millimetres in diameter. Sometimes there are vitrified rays going out from a central point to a distance of four or five inches. Sometimes a block detached from the mass appears as if bored through by a cannon-ball, the hollowed passage being quite vitrified. The thickness of this vitrified coating or stratum never exceeds a millimetre, and is sometimes not more than the quarter of that depth. The varying colors which it presents depend on the qualities and composition of the rock. The same may be said as to its transparency. On the Rungfischhorn the glass thus formed by the lightning is black, owing to the quantity of actinolith which the rock contains. It is brown on La Ruinette, the rock consisting of fieldspar mixed with gneiss containing chloride of iron. Under the microscope these lightning-holes display many interior cavities, which must be attributed to the presence of water in the rock at the moment of melting by the electric discharge. This vitrified material has no influence on polarized light.

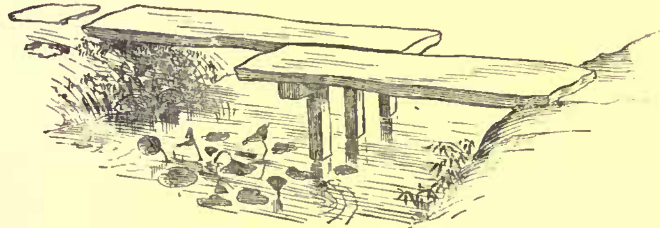
Prototypes of Hollow Beams in Nature.—We have many instances, in the vegetable kingdom, of the extreme rigidity and strength of circular tubes: the stems of the grass tribe generally are remarkable for their lightness and strength; the common wheat-straw and the river reed are familiar examples in our own climate; but in the tropics the gigantic stems of the bamboo and other grasses tower sixty feet above the jungle, and are extensively employed as beams for covering buildings, and even, in some cases, as the transverse bearers of light suspension bridges. The angler's bamboo rod is the most perfect of tubular beams. Tapered off in proportion to the strain, its silicious coat (as in all the grasses) defies compression, while it is internally lined with woody fibre to resist extension in every direction. Its strength, lightness, and stiffness are thus equally marvellous, and we cannot fail to be struck with the provision of diaphragms throughout the whole tribe, to preserve the circular form, which addition would certainly have much modified the results obtained from thin circular and elliptical tubes of wrought iron. The bones of animals are oval, the depth being always in the direction of the transverse strain. But the more special province of the bones appears to be their action as pillars or struts, in forming immovable fulcra for the reaction of the muscles; and since any yielding would involve a great increase of motion in the muscle itself, we find bone among the most incompressible of known substances. The square form of stem characterises a very extensive natural family of plants—the labiate tribe, of which the beautiful dead nettle of the hedgerows is an example, though it is difficult to assign any mechanical reason for this peculiarity, which appears rather to be typical of the general development of these plants. But in the feather-bearing part of the ordinary quill we have a most remarkable example of the strength of the rectangular form. Here, again, every dimension is tapered down in proportion to the strain, with an accuracy defying all analysis; the extended and compressed portions are composed of a horny substance of prodigious strength, though extremely light and elastic. The beam is not hollow, but to preserve its form it is filled with a pithy substance which replaces the clumsy gusset-pieces and angle-irons of the tube without interfering with its pliability. The square shaft is peculiarly available for the attachment of the deep vanes which form the feather, and, as the angular form would lacerate its active bearer, an exquisite transition to the circular quill at the base is another striking emblem of perfection. The imitation of such mechanics, so wonderfully adapted to such a medium, appears hopeless; but we are indebted to the flying philosopher, if his attempt only calls attention to such design, and induces us instructively to contemplate the beauty of a feather.—*Edwin Clark.*

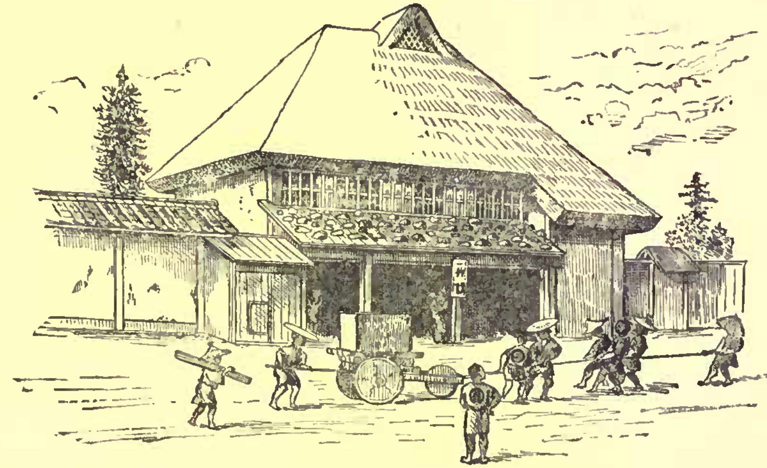
TRADE SURVEYS

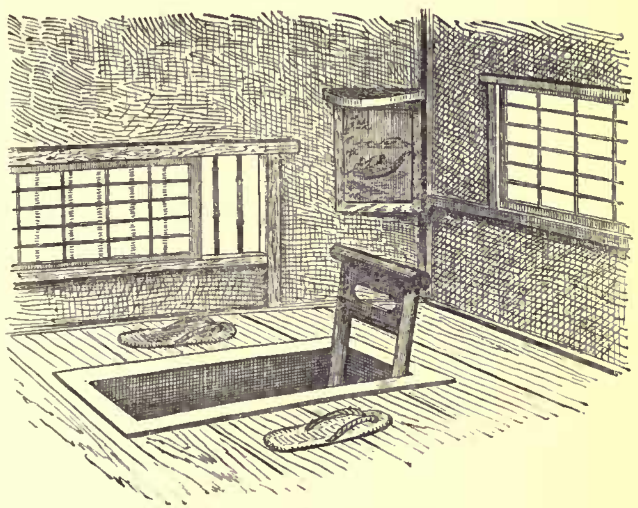
A few of our correspondents among architects and builders, especially in the Middle and Western States, have recently referred to the probability of a decline in rents of offices and houses in cities and towns. There are evidences of this downward tendency here and there. The information available is not sufficient to justify the formation of an opinion. It is well, however, that attention is being called to the fact, if the fact exist, and to the probability of such a result. It is, of course, possible to erect more houses and more offices than can be occupied, and, on the other hand, it is possible for mishaps of some kind or other to overtake renters and oblige them to adopt economic measures. Competition may be, and probably is, setting in a little more actively among builders and landlords. It does not follow that any harm will flow from this. There is nothing to be gained by undue building activity, and nothing to be lost by reasonable competition. Low rents induce persons of small means to occupy houses of their own. High rents crowd people together in undesirable localities. One of the effects of this competition, be it much or little, will be to stimulate architectural and other improvements, inside and outside; in short, to make better houses, and make them more attractive. Perhaps too little attention has been given to this feature by architects and builders. There is no use in causing alarm by predicting a falling off in demand for house, shop, or office room. The demand must, of necessity, continue. The necessities of the people are constantly expanding, and their ability to enjoy finer things is increasing. From this out, there will be a departure in the direction of what might be termed luxuries in house finishings. Public taste is improving. The old-style house is going. Those who supply building material have, of late, frequently spoken of a sort of recklessness among buyers and renters of houses for elegance within and without. The demand for building material, from decoration down to stone and lumber, is very heavy. Usually at this season of the year demand moderates, and stocks accumulate. Material-men say that they have less on hand now than for years. Brick-makers, in several cities, are practically out of supplies, and besides, have contracts on hand which will absorb all their production to the end of the season. The manufacturers of slate state that their production this year has exceeded that of any former year, and that the prospects for next year are good. The manufacturers of cements have done remarkably well. The lumber-dealers in the Northwest will probably succeed in putting up prices for lumber, but it is doubtful whether the extraordinary supplies will allow the advance to be maintained. The New York, Philadelphia, Chicago and St. Louis consumption for the months of July and August, have been larger than for last year. Piece-stuff throughout the West is wanted faster than it can be supplied, but manufacturers are not anxious for an advance. Prices of lumber are firmer all along the Mississippi. In some localities, however, the opinion prevails that prices will decline. From one hundred and fifty to two hundred cargoes of lumber are arriving weekly at Chicago. The canal-boat trade in the West is very active. Lake freights have advanced twelve and one-half cents from Michigan ports, owing to the active demand for coal and ore. Reports from Eastern lumber markets show great activity. In certain portions of New York timber is very scarce. All saw-mills are well sold ahead, and some mills are refusing orders. Large receipts of white and yellow pine are reported at Philadelphia and New York, and the tendency of those markets is to improvement. Manufacturing establishments in those centres are running full time, and there is a very active demand for all kinds of wood, especially hardwoods. Shingles and lath are in very urgent request, and a good many factories in New York and Pennsylvania are behind in their orders for sash, doors and blinds. Furniture manufacturers are quite busy, and have been liberal purchasers for maple, elm, walnut, oak, poplar, cherry, and two or three other woods. The iron-trade holds its own. Importation of foreign material has slackened up. Sheet-iron is in very active demand; nails are wanted in large supplies in both the East and West; but even under this active demand prices have weakened a little. Thirty thousand tons of rails were contracted for last week at $34.00. Builders' hardware of all kinds continues in abundant supply. Under the increasing demand manufacturers, in common with manufacturers in other branches of the iron trade, anticipate a little improvement. All the great industries continue in a healthy condition, and buyers have about concluded that the wisest policy to pursue is to place orders for supplies to be delivered during the next three or four months. There is nothing in the situation to justify the apprehensions of a general advance in prices. The manufacturing interests themselves do not desire it. A vast amount of capital might be tempted into reproductive channels, where its employment at remunerative rates could only be temporary. Reports from between twenty and thirty of the leading railroad lines show a further improvement in returns. The volume of traffic is increasing. There is also a steady increase in bank clearings in the larger cities. The earnings of railroads show an increase for August, as against August last year, and also a slight increase for the seven months of this year, as against the same seven months of last year. Textile manufacturers are buying raw material freely, and crowding productive capacity, with well-grounded confidence that the demand will absorb all the goods they will have the courage to make, and the judgment to make in attractive shapes and styles. The coal trade is beginning to improve both East and West. The anthracite combination will likely make the October output three and one-half million tons. The bituminous mines will be operated with more activity after October 1. The hardware manufacturers in the New England States have distributed more goods during the past three mouths by ten per cent than last year, and the larger concerns are employing additional force in order to run their capacity to the fullest extent. In the heavier industries the same favorable reports are received this week. There are twenty-five locomotive works in the country, and the only idle one will shortly resume with a good supply of orders. There are one hundred and eight car-wheel works in the United States, and, so far as known, none are idle, and railroad managers are placing orders for winter and spring supplies. All of the eighty-five car-works have business enough to run ten hours a day, and some few are running over time.

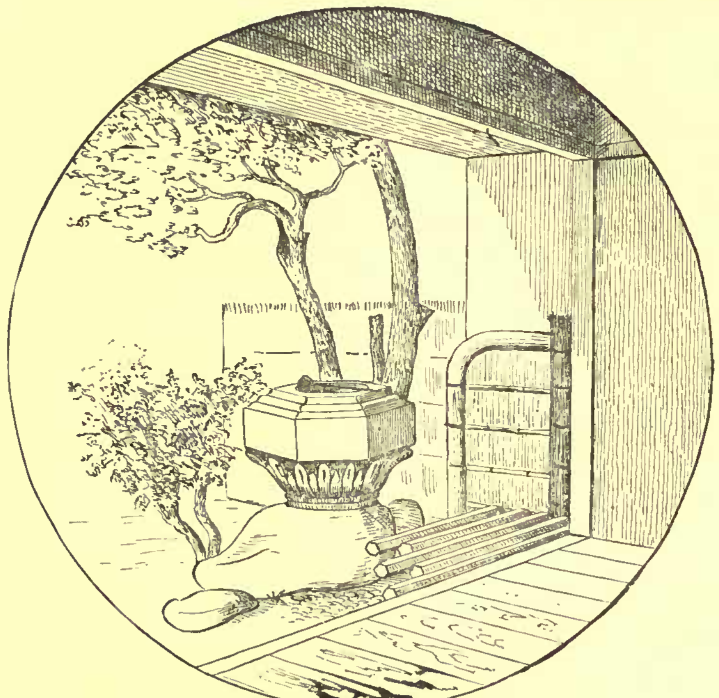
On the other hand, it is necessary to avoid self-deception in these encouraging indications. Never in our history was there greater need of wise and true statesmanship. Our finances are to-day in a healthy condition. There are the same dangers to-day as there always have been of making mistakes and not properly providing for the expanding demands of the country. The possibility of a scarcity of currency has been referred to by careful thinkers. The danger is not on the surface. Other thinkers have pointed to the danger we are in from over-production, and are loud in their protests against a too rapid increase of industrial capital. The only protection against danger of this kind is the enlightenment of the public through trade combinations, well-edited special journals, and a more careful attention by the managers of our great industrial and business enterprises to the tendencies and influences and causes at work throughout the country at large. No one industry can succeed within itself; all are inter-dependent. A certain volume of currency is a necessity. A scarcity in that direction is the precursor, frequently, of trade depression. The producing interests are doing their full duty. The railroad-builders are seeking the aid of money-lenders to extend railway construction faster than absolute necessity calls for. Less unnecessary railway construction has been done this year than in any previous year, and there are fewer miles of road under receivership to-day than there have been for many years. The great bulk of railway mileage is earning fair dividends, and is opening up opportunities rapidly for new towns and cities, for new men and new capital.

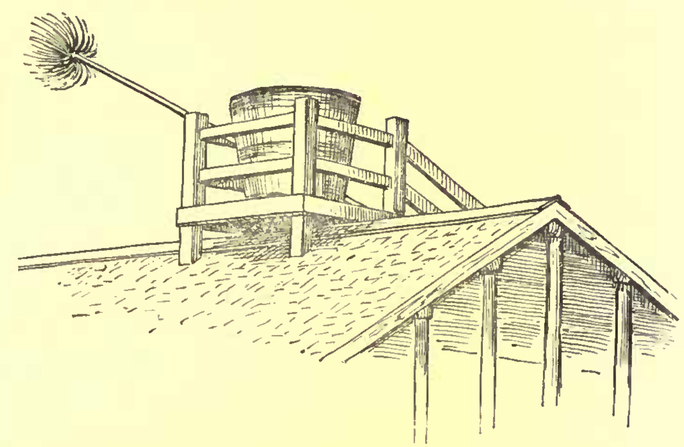

Swallows Nests.


Foot-Bridge.


Country Inn.


Privy.


Chodzu-bachi.


Fire-bucket.

SKETCHES FROM PROF. MORSE'S "JAPANESE HOMES."

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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CONTENTS

A RATHER curious discussion is just now going on in New York among the plumbers, the journeymen being on strike, while the masters are engaged in forming associations to protect themselves. The exact cause of the strike is not very obvious. The journeymen seem to wish to have it understood that they are trying to prevent the masters from having more than a certain number of apprentices, on the ground that those who have too many are tempted to send them to do the work of more competent men; but it is not quite clear that other points are not involved, or may not be before the contest ends. The weak point in the journeymen's argument, which is set forth very calmly and clearly in some of the daily papers, is its failure to show any close connection between apprentices and bad plumbing, and as the *Evening Post* well points out, the sort of work now frequently done by journeymen in good standing in the plumbers' union does not say much for the zeal of its members in their "endeavors to create first-class mechanics," about which they make such loud professions, or indicate that the limited number of apprentices which, if they had their way, would be admitted to the shops, would invariably be properly taught their business. In fact, so far as the teaching of boys goes, it is obviously much more for the interest of the masters to see that those who wish to learn the trade should be thoroughly instructed than for that of the journeymen, and experience in other trades has shown that the workmen's unions generally look with little favor on the technical schools which the masters, who naturally wish to have their apprentices as efficient as possible, encourage with substantial favors. Whether the masters are tempted to risk the lives of their customers by sending these boys, before they are fully instructed, to do work which ought only to be entrusted to men of experience and skill is another thing; but the fact that the master is responsible for all the blunders of his apprentices serves as a wholesome check upon carelessness in this respect, while, so far as the public is concerned, it may be questioned whether the mistakes of a well-meaning apprentice would be more dangerous than the intentional frauds practised by members of the organization which claims to have the public health so much at heart. We have quite as much respect and regard as any one for good plumbers, and would like nothing better than to see their business raised to the standing which it deserves, but so long as they suffer themselves to be associated with the sort of men who do the work in many of our city houses, they must be prepared to find other people incredulous as to their zeal for the elevation of their calling.

WE look forward with considerable apprehension to the result of a disclosure which has recently been made by the *Publishers' Weekly* in regard to a manufacturing firm in Topeka, Kan. It seems that in the summer of 1885 this firm, finding its business unprofitable, addressed a circular to each of its sixty employés, setting forth the condition of affairs, and asking the workmen to try for a year to help themselves and the firm by avoiding waste of materials and time, and endeavoring to make their labor as effective as possible. This seems to have been a new idea to the men, but they reflected upon it, and concluded to try the experiment. After the year had passed, the books of the firm, instead of losses, showed increase of product, and decrease of expenses, sufficient to net a handsome profit, and a second circular was issued, thanking the men for their help in promoting the success of the business, and informing them of an increase in wages, with a reduction in the number of working hours. This change, just as it seems, obviously put the firm at a disadvantage in competing with other establishments, but the men, who were intelligent enough to understand this, undertook to make up for it by still greater care and zeal in their work, and at the last accounts the business was still flourishing, and even increasing, and, judging from the result of similar undertakings, will continue to do so until the Knights of Labor interfere, and command the men to desist from the practice of those habits of economy and forethought which are rapidly raising them above their fellows. It seems incredible that men who have once tasted the sweetness of an improvement in their condition, brought about by their own efforts, should submit, at the order of a selfish demagogue, to return to their old helpless and hopeless routine; but the example of the Massachusetts coöperative shoe-shops, the working owners of which, in the full tide of prosperous business, large dividends, accumulation of surplus to be divided in future, and rapid increase in the value of their stock, deliberately closed their own factories, forfeited their contracts, drove their customers away, and abandoned their costly stock and machinery to rust and decay, simply because a walking delegate told them to do so, shows plainly enough how effectual is the system of terrorizing by which the leaders of the labor organizations maintain their control over their poor and timid victims; and we shall not be surprised to hear at any time that the Topeka establishment has been attacked, on some pretext or other, and either closed altogether or forced to return to the old system.

SIR JOHN SOANE, the architect of the Bank of England building, as well as of many others, not content with the wealth and rank which his professional achievements brought to him, devised some very ingenious methods for keeping his memory fresh in the recollection of the public after his death. Having, we believe, no heirs or near relatives, he bequeathed the house in which he lived, together with its miscellaneous contents, to the nation, and, under the name of the Soane Museum, it still attracts many visitors, particularly from among architects, who can appreciate its casts and fragments, and the numerous cork models of ancient buildings, as well as the Reynolds pictures and the illuminated manuscripts. The house was originally a large one, and is made to appear still larger by being divided into a great number of small rooms. Twenty-four of these are now open to the public, but there are still twenty-two rooms which, by direction of the owner, were sealed up before his death, with the stipulation that the seals should not be broken for fifty years. In November next the time will expire and the rooms will be opened. What will be found in them no one pretends to know. All those who were once familiar with the house, and might recollect something about the disposition of the objects in it, have passed away, and it is doubtful whether the twenty-second of November will bring to light more works of art, or simply some piece of family history. A suggestion has been made that this particular date is in some way connected with the fortunes of the family, and it is said that several of the Soanes have died at that season of the year, but it appears that the instances of this kind have occurred since the decease of Sir John, and as it is hardly probable that he was endowed with a second-sight piercing enough to discover its future fatal connection with his family, it is most likely that the day for the breaking of the seals was simply chosen at random for the first display of works, perhaps architectural designs, which he thought would be more interesting to posterity than to his contemporaries.

ACCORDING to the *Revue Industrielle*, the manufacture has begun in France of a kind of building appliance which promises to be useful, and at the same time cheap. The new material consists simply of planks of reeds embedded in

plaster, but the planks are of various thicknesses, and are capable of a great variety of applications. They are readily nailed to a wood framework, or attached by a little plaster to masonry, or to each other, and can be used for furring walls, for making partitions, for deafening floors, or for a hundred other purposes. The process of manufacture is as simple as possible. Four or five wooden planks, about ten feet long, are set vertically on a horizontal table, their ends being separated by strips of wood of the thickness which it is intended to give to the plaster blocks. Plaster-of-Paris and reeds are then put alternately in the spaces between the planks until they are filled, and after the plaster has set, the mould is taken to pieces and the blocks removed and stacked up to dry. The finished material contains about one-half its bulk of reeds, and is, therefore, not only well knit together and tough, but very light and cheap, the weight of pieces one inch thick being about five pounds per square foot, and the cost about three cents for the same quantity. With us, plaster is too expensive a material to be used with economy in this way, but we have great deposits of cement and hydraulic lime which would answer tolerably well in its place, and reeds for the binding material might probably be replaced with considerable advantage by wheat-straw, cornstalks and leaves, or many other waste products of our farms. If well made, a partition of such materials, two or three inches thick, ought to cost, near the place of manufacture, little, if any, more than a stud partition plastered on both sides. Its weight would be about the same as that of a stud partition, so that it could be built on the beams, if necessary, in the same way, and it would have the inestimable advantage of being fireproof.

THE great street in Paris known as the Boulevard Haussman now extends, including that portion of it known as the Avenue Friedland, from the Arc de l'Etoile to the Opéra, just beyond which it suddenly terminates, coming to an end in the Rue Taitbout. From the other side of the city another long and wide street, under the names of the Boulevard Voltaire, and the Boulevards St. Martin, St. Denis, Bonne Nouvelle, Poissonnière and Montmartre, extends from the almost suburban Place de la Nation to a point within ten or twelve hundred feet of the end of the Boulevard Haussman, and then turns at a sharp angle, and, under the name of the Boulevard des Italiens, goes off toward the Madeleine and the Rue de Rivoli. The opposite ends of the Boulevard Haussman and the Boulevard Montmartre are directly in line with each other, and it is not surprising that the idea of connecting them, so as to give to the city a broad avenue of communication between the eastern and western portions, has been long in the minds of the Parisians. Unfortunately, the construction of the Boulevard St. Germain and the Avenue de l'Opéra was so costly as to have given the municipal officials a disinclination to such undertakings, and as the short link which is still wanting in the chain may never be supplied by the public authority, the idea has occurred to certain private citizens to undertake the work themselves, seeking the authority of the city government for the necessary expropriation of land, but paying all expenses, including the cost of tearing down the old buildings in the way of the street, and building new ones along the modified line, and trusting to the improvement in the value of the estates abutting on the new street to repay their outlay, with a profit. The author of the project, according to *La Semaine des Constructeurs*, is an architect, M. Letorey, who is supported by a company, or, as we should say, by a syndicate of capitalists, and has made his estimates carefully enough to be able to submit a matured scheme for the approval of the town authorities. According to his proposal, his company offers to assume all the cost of taking land, pulling down and rebuilding, and constructing the new street, with all its sewers and pavements, under the direction of the municipal administration, asking nothing in return except a guarantee by the city of a certain minimum interest on the outlay for a period of thirty years from the completion and acceptance of the street. The work of reconstruction on the line of the street is to be carried out with great care. A competition is to be held for designs for the new buildings, and they are to contain all modern luxuries in the way of steam-heat, electric lamps, telephones and other appliances for convenience, as well as the most artistic decoration. As security for the return of any payments that may be made by the city on account of its guarantee of interest, the rents of all the new buildings are to be paid into the city treasury during the thirty years of guarantee, and at the end of that time a settlement will be made between the city and the company. The property in the abutting estates will, however, remain meanwhile in the company, which is to have the right to sell any of them, and the amount of the city's yearly guarantee will then be diminished by a sum equal to five per cent on the value of the estate sold. As the new street will be in the heart of the busiest section of Paris, and must immediately receive an immense traffic, the authors of the scheme believe that the work will in the end cost the city nothing, and that they can themselves afford to pay the twelve million dollars which is the estimated expense of the whole, and give the city the cost of sewers, sidewalks and pavements, for the sake of securing the enhancement in the value of the remaining land. Whether the municipality will accept the offer remains to be seen, but the idea of carrying out such an undertaking by private enterprise is worth keeping in mind. There are many places where street improvements of this kind might be made by private individuals at a profit, and if the tax-payers could through private enterprise be relieved of some of the expense which attends street widenings or extensions, the work of improving our older towns would go on much more rapidly than it does now.

THE *British Architect* calls attention to the fact that the International Copyright Convention, which met recently at Berne, Switzerland, and concluded an arrangement for the protection of the interests of authors and artists throughout the world, included in its list of the kinds of artistic property which it proposed to protect all "plans, sketches and plastic work relative to geography, topography, architecture, or science in general." We believe that the United States was not represented in the Convention, the official view of copyright which is taken in this country being somewhat peculiar, but the International Union, which was permanently established by the Convention, has extended an invitation to us to join with the others whenever we see fit to do so. At first sight an architect's interest in copyright protection abroad seems to be much less than that of an author, but when the new Union, which is well supplied with intelligence and determination, begins to make progress with its work, we are disposed to think that the advantages which it offers to architects will appear of very considerable importance. It is true that there is difficulty in preventing the virtual copying of a design, since variations are generally made in the copy which serve to cast doubt on the technical similarity of the two; but if the Union does what it proposes for the defence of intellectual property, not only designs, but details, relating to construction as well as artistic effect, will be guarded for the owners, who, in this age of universal interchange of ideas, may often, with proper help, find in foreign countries a better reward for their efforts than in their own.

ON the twenty-first of September last a competition took place in France, under the auspices of the Northern Industrial Association, between firemen, the prizes offered being sums of money varying from twenty to fifty dollars, to which were added a silver medal and a diploma. The object of the competition was to encourage men employed in this modest business to try to learn, by practice and study, to do their work well, and the competition was so arranged that all the competitors should gain something in knowledge if not in money. According to the programme, which we find in the *Revue Industrielle*, the competition was to extend over two days. On the first day the men worked under the advice of engineers and inspectors connected with the Industrial Association, and could get all the information that they chose to ask for. On the second day they were left to themselves, to put in practice all the knowledge that they possessed, and the works of this day determined the result of the competition. According to the best mechanical engineers, the economy with which a steam-boiler can be managed depends greatly upon the skill and attention of the fireman, and one who can tell just when his fire needs coal, and can feed it so judiciously as not to check combustion and drive off the best part of his fuel into the air in the form of smoke, may save for his employer a considerable sum every year; and there are few employers who, finding themselves well served in this respect, would not be willing to return to the fireman, in the form of increased wages, a part of the money which his efforts had saved for him.

ANCIENT AND MODERN LIGHT-HOUSES.[1] — III.

THERE is a lofty and ancient tower overlooking the Atlantic Ocean at Corunna, Spain. It is called the Pillar of Hercules, and it is thought that the name Corunna may be a corruption of the word "Columna." By some writers the origin of this tower is attributed to the Carthaginians, by others to Caius Servius Lupus, who dedicated it to Mars. It was restored by Julius Cæsar, and again by Trajan. Its architecture relates to remote antiquity. A tradition states that it was erected by an ancient king of Spain in heroic times; it is now ninety-two feet high. At Ravenna there is a large square tower standing out from the side-walls of the Church of Santa Maria in Porta Fuori, and now used as a campanile or bell-tower: it is supposed to be the pharos of the port constructed by Augustus. In the fifth century this port was so silted up as to be obliterated, and its site was converted into gardens.

The beautiful light-house at Genoa, called Torre del Capo, was originally built on the promontory of San Berrique in 1139, and first lighted in 1326. It was removed in 1512, and re-built by the Republic in 1643. It is a square tower, in two stories, with battlemented terraces, the lower portion nine metres square, the upper seven. Rising from a rock forty-two and one-half metres above the sea, it carries its light at the height of one hundred and eighteen and one-half metres above the water. In 1841 it was fitted with a Fresnel, first-order lens: for beauty and elegance of structure this historic light is one of the finest in existence.

The Pharos of Meloria was built by the Pisans in 1154. It indicated the direction to be taken by ships bound for Porto Pisana, and gave warning of a dangerous sand-bank. This tower was three times destroyed — in 1267 by Charles of Anjou, in 1287 by the Genoese, and in 1290 by the Guelphs. Having determined to abandon Meloria, the Pisans erected, in 1304, the light-house which still exists at Leghorn. It is celebrated by Petrarch. Standing near the entrance of the harbor, to the south of the new mole, it rises forty-seven metres above the level of the sea. It is built of stone, in the form of two battlemented cylinders, surrounded at the base by a polygonal enclosure of thirteen sides.

EDDYSTONE LIGHT-HOUSE.

TO THE KING: —

"I have it not in my power to present YOUR MAJESTY with a fine piece of writing, or of drawing; neither literature, nor the fine arts having been much the objects of my study; but I humbly submit to YOUR MAJESTY, a plain account of the construction of a plain and simple building, that has nevertheless been acknowledged to be, in itself, curious, difficult, and useful; and, as such, I trust, worthy of observation."[2]

Eddystone, the most famous of modern light-houses, built and destroyed so many times, has a history of its own, and though the present structure is not the one built by the famous Smeaton, yet we owe to his genius and strong common sense the design of a tower which has become a type.

Eddystone Rocks, probably so called from the various and conflicting currents running through them, are situated about S. S. W. from the middle of Plymouth Sound, nearly fourteen miles from the town of Plymouth, and ten miles from Ram-Head, the nearest point of land. They are nearly covered at high water, and, being just within the line joining Start and Lizard Points, they must have been very dangerous to vessels coasting up and down the Channel, before they were marked by a light; in fact, many a rich craft, homeward bound from foreign ports, has been lost upon them. From the position of these rocks, near the entrance to the English Channel, they are exposed to the full force of all southwest storms, and what still further augments the force of the waves is the fact that these rocks stretch across the Channel for about six hundred feet, and slope gradually to seaward, so that when the sea is calm elsewhere yet the ground-swell, running up their slope, breaks with great violence; and even when there is only a moderate swell from the southwest, yet, owing to the peculiar shape of the House Rocks, the water flies thirty or forty feet high.

Without going into further detail, it will be seen that the erection of a light-house on this exposed place was an arduous and dangerous undertaking. Yet, in 1696, there having been so many fatal accidents to vessels running on the rocks, there was found a man hardy enough to attempt the task. This was Mr. Henry Winstanley, of Littlebury, in the County of Essex. Mr. Winstanley had a certain turn for mechanics, but his ingenuity ran to the grotesque. At his house in Littlebury there were various amusing and startling contrivances: in one room there was an old slipper carelessly lying on the floor; if you gave it a kick to one side — a most natural thing to do — a ghost would start up before you; if you sat down on a certain conveniently-situated chair — to look at the ghost at your ease, perhaps — you would be immediately clasped by a couple of arms, so strongly and effectually that you would need the assistance of your attendant to release you; should you rest in an arbor in the grounds by the side of a canal to meditate on these marvels, you at once found yourself afloat in the middle of the canal, there to remain until the manager chose to return you to shore.

This bent of Mr. Winstanley's probably accounts for the whimsical structure he erected for light-house purposes. This structure took him four years to erect, the entire work of the first year consisting in drilling twelve holes in the rock and fastening in them twelve large irons. The second year a pillar twelve feet high and fourteen feet in diameter was built. The third year the diameter of the pillar was increased to sixteen feet, and the tower was completed to a height of sixty feet, or to the top of the vane eighty feet, and lighted for the first time the 12th of November, 1698. The fourth year, finding that the sea at times buried the lantern, the thickness of the tower was further increased to twenty-four feet, the tower made solid for a height of twenty feet, the upper part of the building taken down and enlarged, and the height of the tower raised forty feet; yet the sea in storms appeared to fly one hundred feet above the vane, and at times would cover half the side of the house and lantern as if they were under water.

Mr. Winstanley does not state of what material he constructed the base of his tower, but from the appearance of a drawing — said to be made at the rock — it would appear that the material used was stone, and that the joints were protected by iron hoops, to prevent the mortar washing out.

The picture[3] shows the completed tower. With all its whimsicalities and absurdities — its bay-window, derricks, ornamental gim-cracks and mottoes, it was a brave and heroic deed to erect it. Some idea can be formed of the violence of the storms which it withstood, as, after it was finished, it was commonly said that it was possible for a six-oared boat to be lifted up by a wave and driven through the open gallery. Mr. Winstanley believed in its strength, and had the courage of his convictions. In November, 1703, he went to superintend some repairs, and some one expressing fears that the structure was not strong enough, and some day might be overturned, he replied: "I am so very well assured of the strength of my building that I should only wish to be there in the greatest storm that ever blew, that I might see what effect it would have upon the structure."

His wish was gratified. While he was there with his workmen and light-keepers, on the 26th of November, a tremendous storm visited Great Britain, and on the next morning it was found that the light-house had disappeared, with all the people in it. Nothing was ever seen of it except a few of the large irons used for holding it to the rock, and part of an iron chain jammed in a crevice. At the same time that the light-house was destroyed, the model of it, in Mr. Winstanley's house at Littlebury, in Essex, two hundred miles distant, fell down and was broken to pieces. Not long after this accident the *Winchelsea*, a homeward-bound, Virginia man-of-war, was wrecked upon the rocks on which the light-house stood, and most of the crew were drowned.

Though Winstanley proved that it was not impracticable to build a light-house on the Eddystone rocks, and though the light had shown itself to be of great use, yet it was not until the spring of 1706 that an act of Parliament was passed "for the better enabling the Master Wardens and Assistants of Trinity House at Deptford Strand to re-build the same." The work was commenced the following July. By this act the duties payable by shipping passing the light were vested in the corporation of Trinity House, and they were empowered to contract for its erection. In consequence of these powers, they employed a Capt. Lovel, or Lovet, to build it, giving him in payment the duties for a term of ninety-nine years, commencing from the date the light should first be exhibited and continuing so long as it should be shown.

Captain Lovet engaged Mr. John Rudyerd to be his engineer — an apparently strange choice, as Mr. Rudyerd was a silk mercer, who kept a shop on Ludgate Hill, London.

This choice proved, however, to be a happy one. Mr. Rudyerd avoided the errors of his predecessor; he chose a circle instead of an irregular polygon for the plan of his building and omitted the unwieldy ornaments, the open gallery, the cranes, and other contrivances.

Rudyerd's light-house was a frustum of a cone, twenty-two feet eight inches in diameter at the base and fourteen feet three inches at the top, sixty-seven feet high to the floor of the lantern; the height of the centre of the light was nine feet above the balcony floor, and the total height of the tower from the lowest part of the base to the ball on top of the lantern was seventy feet.

It was built mainly of wood ballasted with stone; this is probably due to the fact that Mr. Rudyerd's associates in the work were Mr. Smith and Mr. Morcut, shipwrights from the King's yard at Woolwich, and further accounts for the structure being more in the nature of ship-joinery than of ordinary carpenter's work.

To prepare the foundation the surface of the rock was first approximately levelled off in steps, in which holes were drilled to receive heavy iron bolts or branches, as they were called, which were in their turn securely fastened to the timbers.

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[1] Continued from page 98, No. 557.

[2] Extract from the dedication of John Smeaton's narrative of the building, and description of the construction of the Eddystone Light-house with stone. Second Edition. London, 1793.

[3] See Illustrations.

These holes were made dovetail in shape — two and one-fourth inches wide, seven and one-half broad at top, eight and one-half at bottom and from fifteen to sixteen inches deep, and as they could not all be made alike, each bolt was forged to fit its respective hole; the latter were made four and one-half inches broad at the surface of the rock and six and one half at the bottom; when placed in the hole a space would thus be left three inches wide at the top and two at the bottom in which a key could be driven.

After all the holes were drilled and the bolts and keys fitted, the holes were cleared of water as far as possible and filled with melted tallow; the bolts and keys were then heated to a blue heat and driven home; thus all the interstices would be filled with the tallow; when this was done coarse pewter was melted in a ladle and run in; it of course displaced the tallow, or a greater part of it. This answered so well that fifty years afterward when these bolts were taken out the tallow still remained fresh and the iron not rusted.

These bolts were not placed very regularly, but the plan in general was to arrange them in two concentric circles, one about a foot inside the other; in addition there were two large bolts fixed near the centre, to which was attached the mast.

The lower part of the tower consisted of a solid oak grillage, carried two courses higher than the top of the rock; on top of this were placed five courses, one foot thick, of stone, laid without cement, but held together with iron cramps, then two courses more of solid timber, surrounded with timbers conforming to the contour of the circle, so that when the outside upright timbers were placed the bolts fastening them would not enter the horizontal timbers with the grain; some courses of the lower grillage were arranged in the same way.

The outside of the tower was then formed of upright timbers, bolted to the grillage courses and to each other, and terminated by a planking three inches thick which formed the floor of the lantern. The seams between these uprights were caulked with oakum and payed with pitch.

The tower was perfectly plain except the cornice at the top and a protection at the bottom; the former served to throw off the sea at the top and prevent it from striking the lantern. The latter was probably an afterthought to protect the bases of the uprights from the shock of the waves.

This structure was a great advance on the first one; it stood for forty-six years and was then destroyed not by a storm but by fire.

Three years after it was commenced a light was exhibited from it, and the next year, 1709, it was entirely completed.

Louis the XIV was at war with England during the construction of this light, and once a French privateer captured all the men at work and carried them to France with their tools. The captain quite prided himself on his achievement and expected to be well rewarded, but the king, when he heard of it, clapped the captain and his crew into prison, released the workmen, loaded them with presents and sent them back to their work saying that, though he was at war with England he was not at war with mankind and that the Eddystone light-house was so situated as to be of equal service to all nations navigating the English Channel.

No repairs of any moment were necessary until the year 1723 when it was found that the lower ends of the uprights, especially on the lower side were being eaten by a small worm, possibly the limnoria; they were then thoroughly repaired. In 1744 there was a tremendous storm which tore away thirty of the uprights and made a breach into the store-room, but by great exertion this disaster was repaired before the close of the year.

For many years after the light was established there were but two keepers; this number was ample for its maintenance, but it so happened that one of the men sickened and died, and the other, fearing to throw the body into the sea lest he might be charged with murder, allowed it to remain in the light-house and hoisted a flag, which was the signal that he needed assistance.

The weather was so bad for a whole month that the attending boat could not land, and when they finally succeeded the stench was so noisome that it was with the greatest difficulty that they could dispose of the body by throwing it into the sea, and it was not for long after that the rooms could be rid of the foul odor. After this the proprietors employed three men, to guard against the recurrence of such an accident. This also allowed each one in turn to go on shore for a month during the summer.

The fire which destroyed this light-house, which had withstood the fiercest storms for nigh half a century, took place in December, 1755. The keeper going to snuff the candle at 2 A. M., found the lantern full of smoke, and when he opened the door was driven back by a burst of flame.

The candles were twenty-four in number and weighed two and one-half pounds each; their long continued use must have thoroughly dried the woodwork of the roof of the lantern which besides was probably covered with soot, so that a spark would easily ignite it.

The poor keeper did what he could to put out the fire; he after a while succeeded in awakening the other two keepers and they all tried to throw water on the flames, but as it had to be brought seventy feet high, they soon found their efforts unavailing, and in addition one of the keepers, the one who discovered the fire, was disabled by a curious accident.

While he was looking upwards, endeavoring to see the effect of the water he had thrown, a shower of molten lead fell on his head, neck and shoulders — part of it ran inside his shirt-collar and burned him badly; he also felt an intense burning inside, and supposed that part of the lead had passed down his throat.

The three men gave up the unequal struggle and descended from room to room, as they were driven by the heat and melting metal.

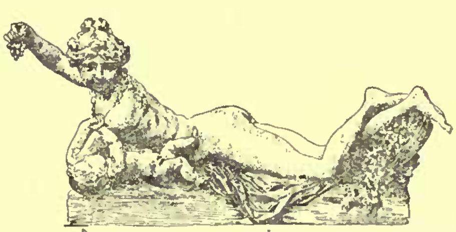
Early in the morning the fire was seen on shore, and a philanthropic gentleman fitted out a fishing boat which arrived at the light-house at 10 A. M. The fire had then been burning eight hours; the light-keepers had been driven from the tower, and to avoid the falling timbers and red-hot bolts, had taken refuge in the hole or cave on the east side of the rocks under the iron ladder, near the landing.

The men were stupefied, and the wind being from the east made a landing extremely hazardous, if not impracticable. They, however, were saved by the crew first anchoring the large boat, then a small boat was rowed toward the rock, paying out a rope which was attached to the large boat; when near enough to the rock a heaving-line was thrown to the men. Each light-keeper in turn fastened the rope around his waist, and jumping into the sea was hauled into the boat.

As the fishing-boat could do nothing to quell the flames it returned to Plymouth to land the keepers; one as soon as he got on shore ran away, it is supposed in a panic; the one burned by the melted lead was sent to his own house for medical attendance; he was ninety-four years old, but remarkably active considering his age. He told the doctor that he had swallowed the molten lead, and that he could not be cured unless it was removed. He lived until the twelfth day, when he suddenly expired—the doctor opened his stomach, and found therein a solid oval piece of lead weighing more than seven ounces. The doctor sent an account of the ease to the Royal Society, but that wise body pooh-poohed the whole matter, and doubted the truth of the story. This nettled the good doctor, and to prove that animals might swallow molten lead and still survive, he tried the experiment on dogs and fowls, and found that they did live until he opened them to extract the lead. There is particular mention of one cock, who though dull would eat barley corn, from whose crop was removed a lump of lead weighing three ounces. These experiments seemed to prove the doctor's case pretty effectually, but about all the satisfaction he got was being censured for cruelty to animals.

AN EDITOR'S TRIP ABROAD.[1]—XIV.

FRENCH POLITENESS.—THE ECOLE DE MEDECINE.—THE COLLEGE OF THE SORBONNE.



BACCHANAL AND INFANT
TERRA-COTTA, BY CLODION
REVUE DES ARTS DECORATIFS

After five or six weeks of rather rapid travelling through so many different countries, to say nothing of the confused state of mind in which contact with five successive languages in the same space of time naturally leaves the guide and interpreter of a party, it was very pleasant to get back to Paris and to our letters, and we felt, as the train rolled into the Northern Station, a little as if we were returning home. Perhaps the fact of having changed our lodging-place from the Rue de Rivoli to the Boulevards may have made some difference, but it seemed to us that the city had, since we left it, received an extraordinary influx of Americans. Naturally enough, the prevailing language in the hotel was English, at least among the guests; but on the streets in the neighborhood one was pretty sure to overhear English phrases proceeding from at least one in three of the groups standing on the sidewalks, or looking in at the ever-fascinating shop-windows. Even in the churches, the precious Baedeker, which, however, the English and Americans share with the Germans, appeared to be nearly as common as a prayer-book in the hands of the people present, and at the Louvre it seemed to be the indispensable companion of the greater part of those who had no place in the "escorted parties" which followed each other at short intervals through the rooms. As we had chosen to be our own escorts, we had some curiosity to watch the people who were under more experienced guidance, and it is only fair to say that it seemed to us that they were conducted, at least through the Louvre, with exemplary efficiency and economy of time. For the ordinary tourist, turned in among one or two thousand pictures, with only a few hours to see them in, it is practically impossible to select at a glance those which best merit his attention, and even with such a guide as Baedeker it takes many minutes to hunt up on the walls the particular number referred to in the book, and refer back to the book for the next, so that the system of providing guides, especially such painstaking and well-qualified ones as those which usually seemed to conduct the large parties, who point out successively the best of the pictures, remarking upon them while their flock is studying them, has a great deal to commend it, even to persons who know much more about pictures than most of the visitors to the Louvre.

[1] Continued from page 132, No. 560.

We had nearly finished our sight-seeing, and were called upon to attend to some little affairs, which gave us an opportunity for strengthening the high opinion that we had previously formed of French courtesy and amiability. Perhaps nothing strikes an American abroad so much as the general gentleness and civility of most foreigners, to each other, as well as to strangers, but to me there seemed to be among the French a certain affectionate zeal in their kindness which distinguished them beyond the rest.

Perhaps the untiring and thoughtful politeness with which our own friends provided for our entertainment may have made us more ready to observe a similar disposition in strangers, but we could not fail to notice it wherever we had an opportunity to watch the conduct, not of the waiters in the cafés on the Boulevards, or of that portion of the population which begins to wake up at midnight, but of the real Parisians, the modest, industrious and sensitive people who have for two thousand years made the city in which they live the most attractive place in the world. How severely their patience must be taxed by the eccentricities of the foreigners whom they serve with such sweet smiles, probably they alone could say, but even a summer tourist can observe and admire a good many of the manifestations of their tact and good temper. The worst of their trials would naturally come from the lack of a common medium for the communication of ideas between them and their guests; but it is surprising to see how far a little good-will and quickness of mind will make up for this, especially if the other party shows something of the same qualities. As a rule, Americans in Paris who do not speak French seem to realize that it would be desirable to do so, and with this modest idea in their heads they pick up very rapidly the common words and phrases necessary to make themselves understood, but there are some individuals, either English or Americans, who seem to have arrived at the conviction that it is mere perversity in a servant, or "inferior," to be incapable of understanding them, and that nothing is really necessary but an authoritative tone, and a threatening manner, to terrify the delinquent into submission and comprehension. As we entered the hotel once, in some town in Germany, we heard a loud, fierce voice proceeding from the pantry, and as we passed on our way to the dining-room, perceived that a dialogue, or rather, a monologue, was going on between an English-speaking tourist and the youngest of the waiters, who understood no more of his interlocutor's language than the latter did of his. The waiter was a little man, hardly more than a boy, while the tourist was large, stout, and of that habitually exasperated bearing which seems to be most cultivated in the British Isles. If the little servant had been pinned to the wall by a spear he could hardly have been held there more helplessly than by the terrible eye of the Saxon, who stood close before him, transfixing him with a steady stare, while he repeated, slowly, and very loudly, the list of the things that he wanted for his supper, as if he would drive it by force through the other's skull. At each repetition the wretched waiter grew paler, and looked more helplessly from side to side for a chance to escape, until our coming created a diversion, under cover of which he fled, to send back in his place the head-waiter, who knew what "mutton chops, well done," meant. As Frenchmen usually find it much harder to understand English than a German would, on account of the greater difference between their idioms and those of the Saxon, there would naturally be continual misunderstanding among them, if it were not for their quickness and patience, which makes them perhaps the easiest of all foreigners to get along with for persons who are unable to speak their language.

Being intent, so far as opportunity offered, upon the pursuit of professional inquiry, I was glad to avail myself of the kindness which opened to me the gates of the two most important of the new buildings of Paris, the extension of the Sorbonne and the additions to the École de Médecine. The beautiful façade of the library of the latter, on the Boulevard Saint-Germain, had attracted my attention on my first visit to that quarter, but it was not until later that I discovered what it was, and had a chance to understand and appreciate thoroughly M. Ginain's greatest work, which must certainly place him high among the immortals of French architecture. To begin at the beginning, the French Government, having determined to increase very materially the resources and equipment of its famous medical school, whose renown, once unrivalled in the world, has of late years been perhaps somewhat dimmed by the fame of the clinical lectures at Vienna, entrusted M. Ginain with one of the most difficult and complex pieces of planning ever proposed to an architect, requiring him, not only to utilize the existing buildings, but to add several others, all larger and more spacious than the old ones, but conveniently connected with them. This alone would not be a very easy problem to solve with credit, but to increase the designer's perplexities, he was obliged to adapt his plan to a piece of ground not only irregular and awkward in outline, but so uneven in surface that the first floor in some portions of the group of buildings corresponds with the second floor in the adjoining portions. The most important members of the new group were to be the medical library, and two or three large clinic buildings, and of these M. Ginain chose the library to form his main front, making it very long and very narrow, with windows only on the street, and by that means not only getting a good light and plenty of shelf-room, but saving space for his other buildings, at the same time extending this one sufficiently to take up practically all the Boulevard front of the lot, and to give him a most imposing façade, unbroken by any such change of motive as a French architect's principles would require of him if he had divided the frontage between two of the components of his plan. So far as the Neo-Grec implies simplicity of form, with exquisitely studied and unobtrusive ornament, M. Ginain's work may certainly be described as being in that style. To my mind, the only modern building of importance in Paris that approaches it for the architectural perfection, apart from the merit, as sculpture, of the detail, is that greatest of Neo-Grec buildings, the Bibliothèque Sainte-Géneviève; but beautiful as Labrouste's master-piece is, the Ecole de Médecine much surpasses it in effectiveness, attracting the eye from a long distance by its striking but simple outline, and the majesty of the great Ionic colonnade which marks the middle portion. Inside, the library is as simple as such a room could well be. Between the three-quarter shafts of the colonnade open long and high windows, which give an admirable light, sufficient not only for the opposite wall, which is to be entirely occupied by books, but for the spaces beneath the windows themselves, which also afford room for shelves to a height of about eight feet above the floor. The roof, with true French simplicity, is framed with nearly equilateral trusses, presenting a flat, plastered ceiling inside, slightly decorated in relief, and a long roof outside, perfectly straight and unpretending, but of the happiest proportion and effect.

The new buildings for the College of the Sorbonne, aside from their importance as forming a part of the means by which the French Government proposes to raise the Sorbonne into what might be called the great democratic university of the world, had a special interest from being the first important executed work of a young architect, M. Nénot, whose previous successes, as winner of the Prize of Rome, as the author of a remarkable series of restorations of the sacred enclosure at Delos, and finally, as the laureate in the great competition for the Victor Emmanuel monument, had fixed the eyes of the professional world upon him. It would be tiresome to go into the particulars of M. Nénot's plan, which has been repeatedly published, together with those of his rivals in the competition which ended in his selection as architect, and it is enough to say that the portion of the building now in process of construction comprises a vast theatre for the awarding of prizes and degrees, preceded by a vestibule and public entrance of suitable proportions, and flanked on either side by masses of building intended for division into lecture rooms and laboratories, which enclose, between themselves and the great theatre-building, two pretty and exactly similar courts. As the construction had nowhere advanced to the cornice, and the "*ravalement*" had barely begun, I was unable to judge of the probable appearance of the building, but the planning and arrangement were full of interest. Although the walls were not built even high enough to receive the roof, except in one place on the court, the heating-apparatus for the great hall was in place. I knew well enough that heating by steam is less popular on the other side of the Atlantic than with us, but even that did not prevent me from being a little surprised to find preparations made for warming the whole of the immense "Salle des Récompenses," with its appendages, by hot-air furnaces. As in Trinity Church, Boston, and perhaps in other American buildings, M. Nénot had provided for converting the whole of the basement beneath his principal room into a warm-air chamber, with openings through the floor at suitable points. As there would naturally be many points where in winter a supply of warm air would be desirable in the great hall, there were many openings, but I saw no indication of the way in which it was intended to solve what our engineers would perhaps consider the most difficult point in the problem, the equalization of the flow of warm air through them. Many, if not all the furnaces for heating the air were in place, showing the usual brick and iron fronts, with wings for the smoke-pipes, or other radiating members, and one hot-air duct, apparently leading to another room, had been constructed, of iron beams and bars filled in with terra-cotta or plaster blocks; but there was nothing, so far as I could see, to show that a fan was to be put in, or that any means except the natural buoyancy of the heated air would be depended upon to carry it where it was wanted. Fortunately, the climate of Paris is mild in comparison with ours, and it is altogether likely that M. Nénot's plan for warming his great hall, as well as that of M. Ginain for supplying cold fresh air to his library by means of grated openings directly through the front wall, will answer admirably in practice; but they are rather startling so those who have to deal habitually with a winter atmosphere in which mercury nearly or quite freezes. For the rest, M. Nénot's building seemed thoroughly well thought-out and solid in construction. The sub-structure, particularly, was noticeable for the amount of what was practically concrete work of the Roman sort. Not only the vaulting to support the floor above, but many of the larger piers, were built of the roughest kind of rubble, composed of small pieces of "*meulière*," or mill-stone grit, buried in cement mortar. There was hardly any attempt at bond in the piers, and none at all in the vaulting; but the "*meulière*," which resembled in roughness the conglomerate stone employed for certain purposes about Boston, evidently held so firmly to the hard cement in which it was embedded as to form a mass quite as suitable for its purpose, perhaps, as a construction of cut stone, and far cheaper, and bold as the innovation seemed to one brought up with due reverence for headers, through-stones and stretchers, I could not help thinking that M. Nénot had offered a suggestion which, in these days of Portland cement, ought not to be lost sight of.

ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

INTERIOR OF A MOSQUE AT TLEMCEN, AFRICA.

[Gelatine print issued only with the Imperial and Gelatine editions.]

COMPETITIVE DESIGN FOR THE LIBRARY AND MUSEUM, MINNEAPOLIS, MINN. MR. H. L. WARREN, ARCHITECT, BOSTON, MASS.

PARIS VIEWS, AFTER ETCHINGS BY FRANCOIS MAXIME LALANNE.

BROOKLYN LIFE INSURANCE COMPANY'S BUILDING, LIBERTY ST., NEW YORK, N. Y. MR. F. CARLES MERRY, ARCHITECT, NEW YORK, N. Y.

WINSTANLEY'S LIGHT-HOUSE ON EDDYSTONE ROCK.

RUDYERD'S LIGHT-HOUSE ON EDDYSTONE ROCK.

For description see article on "Ancient and Modern Light-houses" elsewhere in this issue.

MÜNTZ'S RAPHAEL.[1]—II.

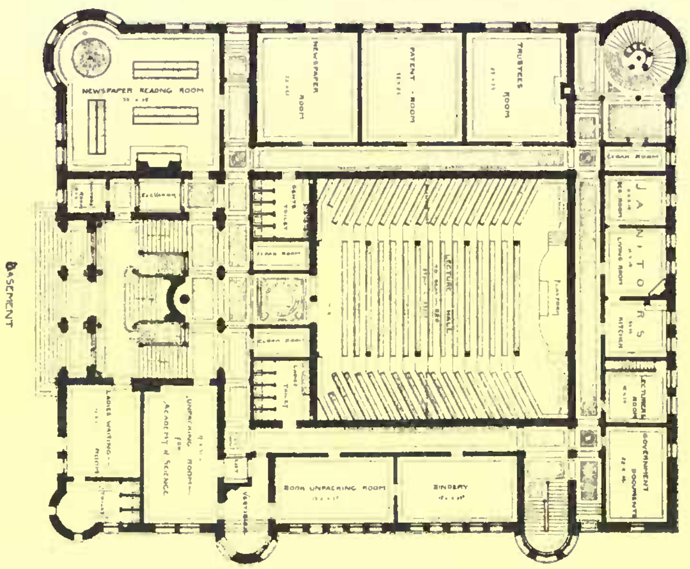


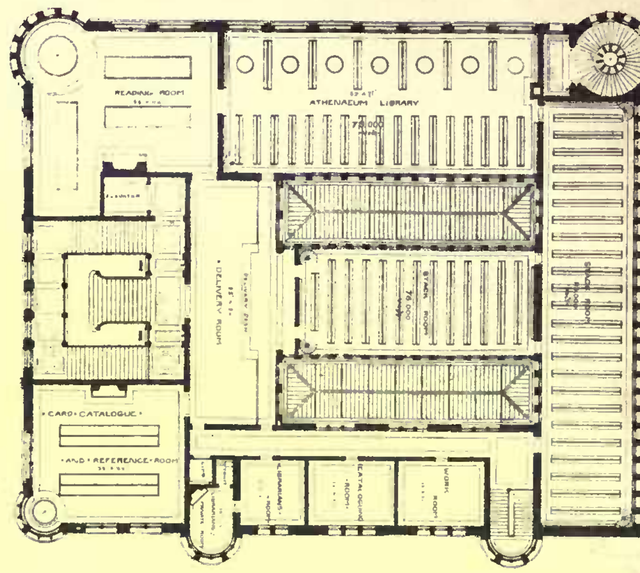
RICHLY endowed by nature, and well stored with all the precepts of the contemplative and elegiac Umbrian School, Raphael felt that the complement of his education, the virile and grandiose qualities, were only to be acquired in midst of the intenser life of Florence, then the artistic centre of Christendom. She supplied the pope, the Italian princes, the kings of Spain, Naples, France, England, and even the sovereigns of Muscovy, Hungary, and Turkey with architects, painters, sculptors, goldsmiths, miniaturists, and medalists. Nowhere was art honored and the artist fostered as in this free town. The painter and the sculptor were the peers of the aristocracy. The government treated with Michael Angelo as power with power. Artistic competitions fermented the whole city. "In contrasting the standing of the leaders of Florentine art with that of their *confrères* of Perugia, Siena, or Urbino, one is tempted to repeat the exclamation Durer let slip — all surprised by the honors paid him at Venice in 1506 — 'Here I am a gentleman; at home a parasite.'" Raphael came to Florence with no flourish of trumpets, for his reputation was but provincial, and he was doubtless chiefly known as the cleverest and most promising pupil of Perugino, whose reputation in Florence, where he had worked with honor and profit, was now decidedly on the wane. Nevertheless, the presence of the master during the pupil's sojourn there, if only temporary, must have proved invaluable, since the former's influence and popularity with both native and foreign patrons who frequented his atelier was still considerable. Raphael quitted his native Urbino in 1504, armed with a letter of recommendation from his protectress, the Duchess Giovanna della Rovere, to the "gonfaloniere" Pietro Soderini (who never seems to have patronized him). This flattering letter runs: "The bearer of the accompanying is Raphael of Urbino. The talent with which he is gifted has decided him to settle in Florence for some time in order to perfect himself in his art. His father was dear to me on account of his excellent qualities. I have no less affection for the son, who is a modest and amiable young man, and I wish him to make as much progress as possible. I therefore recommend him with particular urgency to your Lordship, begging you to assist and favor him as much as you can in every circumstance. Whatever services your Lordship may render him, I shall deem rendered to myself, and I shall be under the greatest obligation to you." This letter, though flattering, as before observed, indirectly but very clearly reveals Raphael's status at the time — that of a gifted young man from the provinces who has still much to learn in "the metropolis" before he can rank with the greatest.

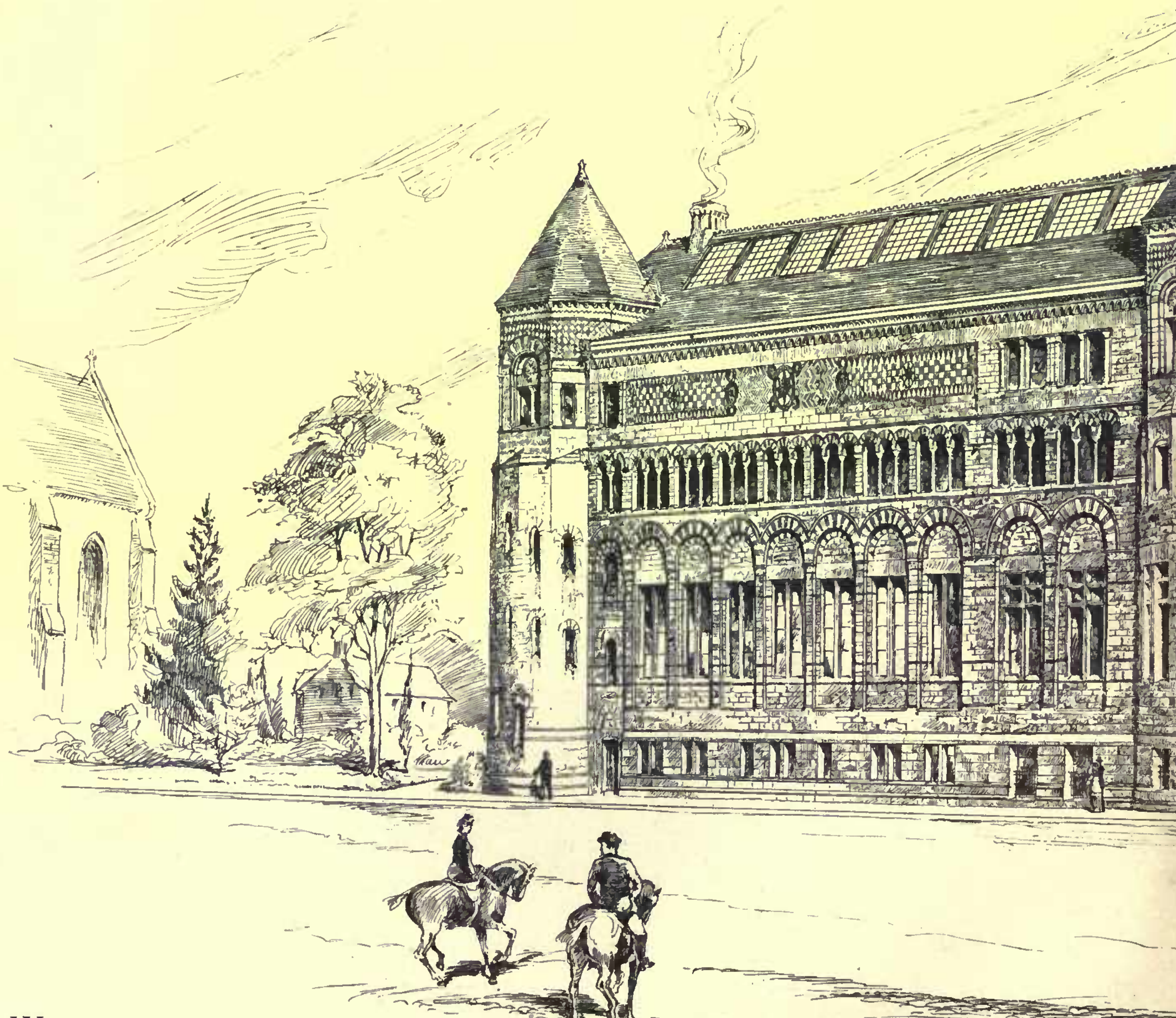
Some years before Raphael's advent, the famous "Casino" of the magnificent Lorenzo, rich in antique marbles, bronzes, and intaglios — the school of Michael Angelo — was swept away in a day's rioting. Fortunately, there were pious hands to gather the waifs from this ghastly shipwreck. Lorenzo's brother-in-law, the historian Bernard Rucellai — not to mention others — especially busied himself in preserving the antiques collected by the Medici, as well as in making new acquisitions, till his gardens, the "Orti Oricellari," could vie with Lorenzo's "Casino," and offered the artists of the day those models in default of which the progress of the Renaissance would assuredly have been checked. As compared with the more marked influence exercised by classic art on Raphael in later years at Rome, the traces of antiquity discoverable in the work of his Florentine period seem faint enough; but it must be remembered that the early Renaissance never absorbed antiquity bodily as in later times. It profited by its lessons, and was more or less inspired by it, but the spirit and style were clearly vernacular. Architects, painters, and sculptors were ever seeking to ferret out the principles that guided their glorious predecessors of Athens and Rome, but they were never servile imitators. Men of the Donatello stamp were too ardently naturalistic to follow resignedly in the traces of any predecessor, however illustrious. It was only at the beginning of the sixteenth century that the imitation of classic models was held to be one of the canons of sculpture. In painting, the triumph of antiquity was retarded, seeing that it was no easy matter for a graphic to assimilate the principles of a plastic art. The school of Padua was the first completely to overcome these difficulties, perhaps too completely, for even its immortal coryphеus, Mantegna (1431–1506), seems to have been hampered at times by classic reminiscences. At Florence the struggle lasted longer. Botticelli's (1447–1518) "Venus," for example, "long, thin, ill-balanced," is anything but classic; yet there is a "fragrance of youth and poetry" about her difficult to find in the more correct and scholarly work of a Giulio Romano (1492?–1546). It is almost impossible to discover any *souvenirs* of antiquity in the paintings of Leonardo, nor does he mention it as an educational means in the "*Trattato.*" But Leonardo was altogether an exceptional character. Michael Angelo got a great deal out of the antique, and Raphael followed the sage example of the Florentine school in this respect, as the "Three Graces" or the "Apollo and Marsyas" testify. Besides the antique, other and not less important agencies were moulding the character and artistic development of Raphael. There was Giotto, founder of the Florentine school, who was named with respect even in high Renaissance days, the sculptors Ghiberti and Donatello, the architect Brunelleschi, the innovator Masaccio, whose "Carmine" frescoes he copied as a matter of course, and last but not least of other illustrious dead, Domenico Ghirlandajo (1449–1494). His beautiful frescoes in Santa Maria Novella are echoed in Raphael's, painted on the walls of San Severo at Perugia.

Of contemporary artists he who unquestionably gained at this time the greatest ascendency over the supple and receptive mind of Raphael was Leonardo, the first intellect of his time, if not of all times. Michael Angelo left his mark there too, but his influence was more strongly felt at a later date. The familiar story of the famous competition between Leonardo and Michael Angelo for the decoration of the Sala del Consiglio is always inspiring, for the effect of these two epoch-making cartoons must have been stupendous. Vasari tells us that Raphael was astounded at the sight of Leonardo's pictures, whose figures are so replete with grace and movement, and studied them in preference to all others. "Little by little and with great pains he abandoned the manner of Perugino, and imitated as much as possible

[1] "*Raphael, sa vie, son œuvre, et son temps,*" par Eugène Müntz, Paris. Librarie Hachette & Cie., 1886. Continued from page 121, No. 559.

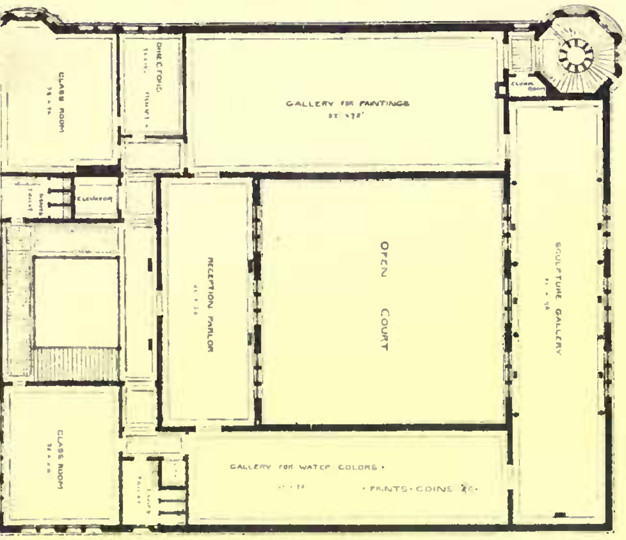


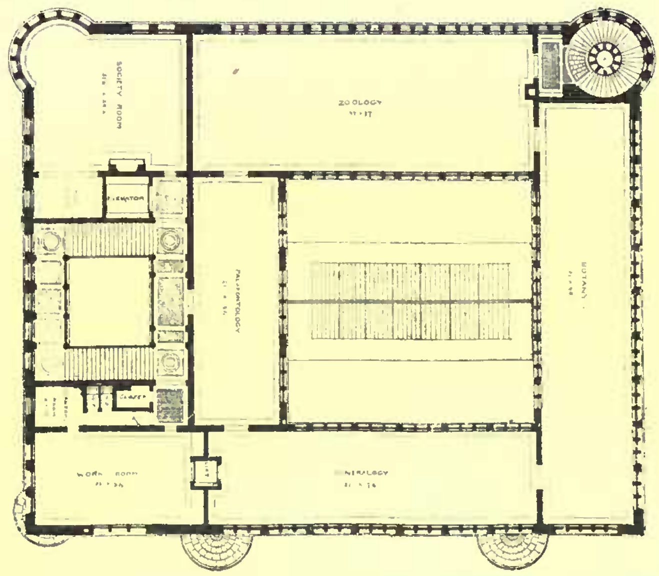




H. Langford Warren. Architect.

… Co.







COMPETITION DESIGN FOR LIBRARY AND MUSEUM BUILDING. MINNEAPOLIS, MINN.

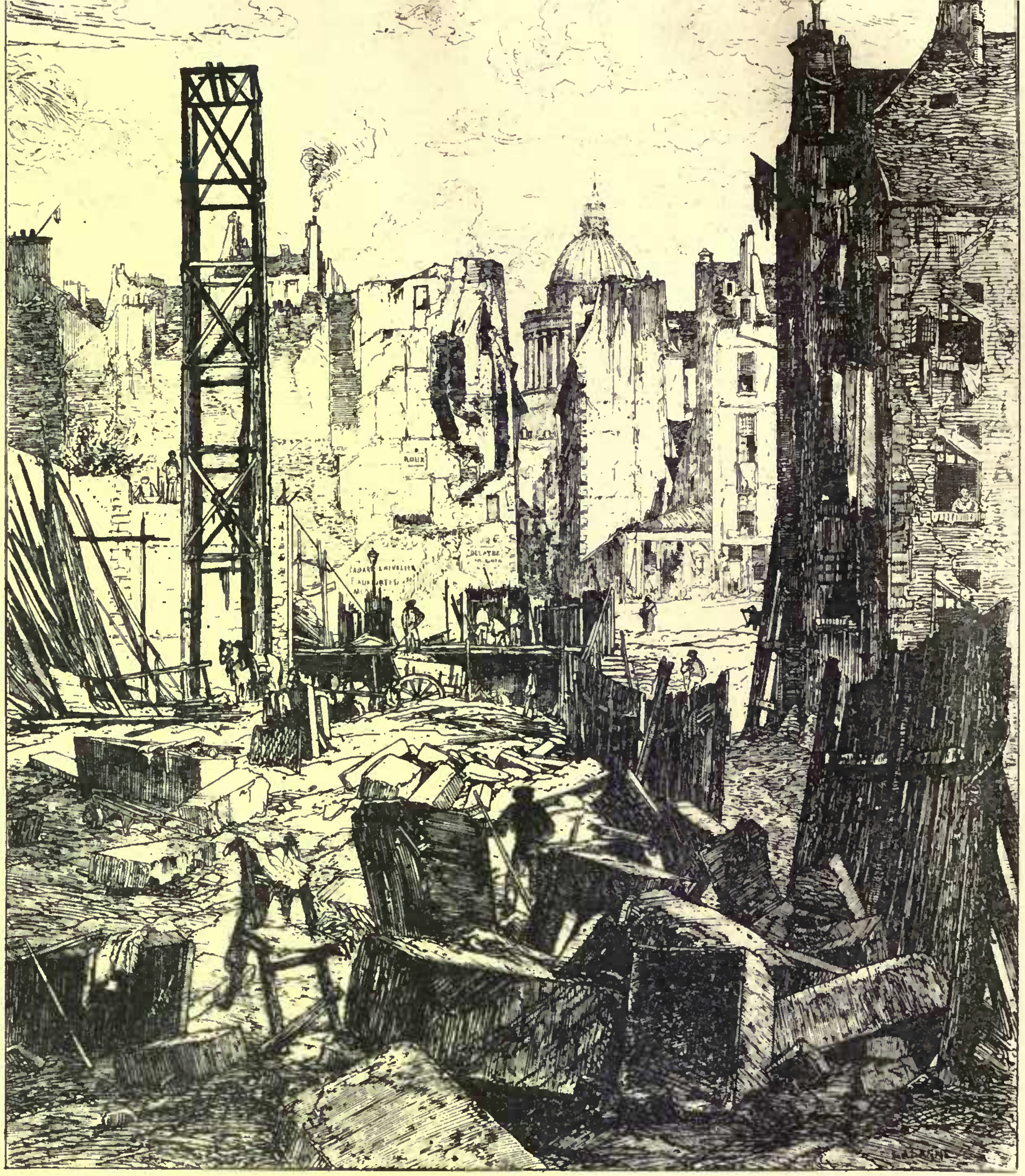
Heliotype Printing Co Boston.



CUSSET.
(Excursion de Vichy.)



RUE DES MARMOUSETS (Vieux Paris)

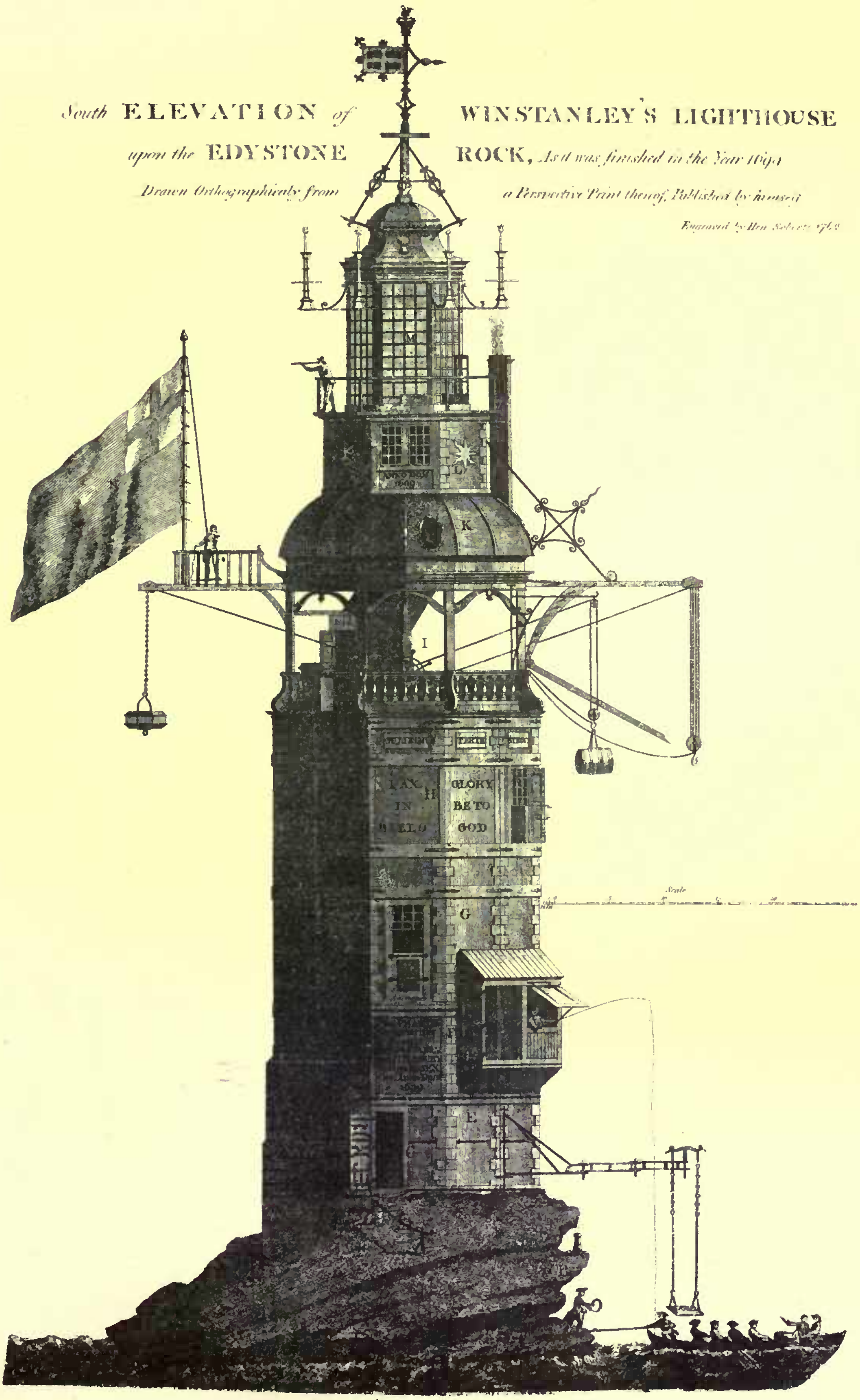


DÉMOLITIONS POUR LE PERCEMENT DU BOULEVARD St GERMAIN.
(Vieux Paris)

Heliotype Printing Co Boston.



VUE PRISE DU PONT S^T MICHEL.


South ELEVATION of WINSTANLEY'S LIGHTHOUSE
upon the EDYSTONE ROCK, As it was finished in the Year 1699
Drawn Orthographically from a Perspective Print thereof, Published by himself
GLORY BE TO GOD



From the Comptoir National d'Escompte, Paris. Millet, Sculptor.



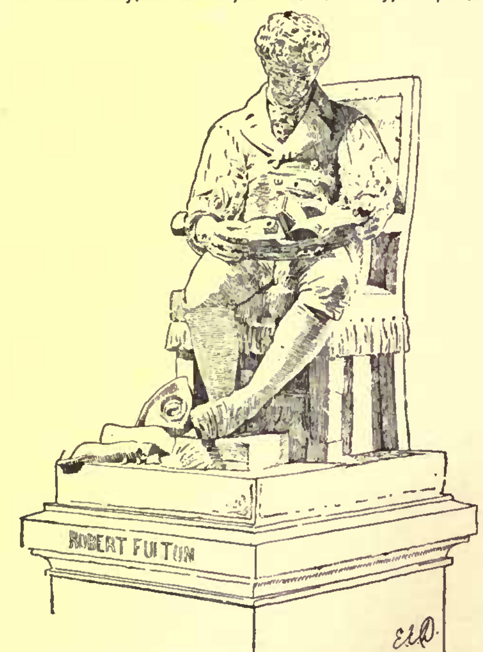
Dr. Nathaniel Bowditch, Mt. Auburn Cemetery, Mass. Ball Hughes, Sculptor.



P. Corneille, Paris, France. Falguière. Sculptor.



Chief Justica Story, Mt. Auburn, Mass. W. W. Story, Sculptor.



Robert Fulton, Washington, D. C. Howard Roberts, Sculptor.

SITTING STATUES.

that of Vinci; but in spite of his efforts and application he could never surpass him in some difficulties. If, as is generally thought, Raphael excelled him in softness, and in a certain natural facility, on the other hand he is in nowise superior to him either in the art of invention or expression, wherein few artists have raised themselves to the height of Leonardo. All that can be said is that Raphael is the one that came nearest to him, particularly by the charm of his coloring." Referring to the comparative effects of the influence exercised on the young painter by Leonardo and Buonarotti, M. Müntz writes: "But if the germs lodged in his mind by the author of the "*Cenacolo*" and "*La Gioconda*" were to fructify, thanks to the intimate sympathy between these two choice natures, the imitation of the painter of the Sistine Chapel was fatal. Raphael sacrificed some of his natural qualities, without succeeding in assimilating those of his rival: he exhausted himself in sterile efforts."

Let me remark here, *en passant*, that Michael Angelo is not to be imitated. A whole generation of artists that came immediately after him was tainted by endeavoring to appropriate qualities that are inalienable from their possessor. This sublime artist — perhaps the sublimest that ever lived — was a genius entirely *sui generis*. His work was very strongly impressed with his own personality, and his development was of a one-sided character. If I may be permitted to apply a most informal appellation to so heroic a personage, Michael Angelo was not a good "all-round" artist. Men like Phidias, Da Vinci and Raphael were, and are, therefore, safer models. Michael Angelo certainly conveys his lessons; but he is not to be followed. Raphael made a half-hearted effort to imitate some of the versatile Leonardo's caricatures, or, rather, character studies, but he soon abandoned the attempt; for these phrenological abnormities were contradictory to his nature, enamored only of the beautiful.

After Leonardo, the artist who held the highest place in Raphael's esteem was Fra Bartolommeo della Porta, the champion of Savanarola, and the *résumé* of Florentine art from Giotto to Da Vinci and Buonarotti. The influence of these two painters was reciprocal; each had something to say that the other had never heard. Their intimacy lasted almost as long as they themselves, for the dominican, like Raphael, died young. Crowe and Cavalcaselle suppose with much probability, that despairing to establish anything like intimate relations with either Leonardo or Michael Angelo, Raphael sought the society and instruction of the painter-monk, then somewhat neglected. It was fortunate that on his arrival at Florence he could meet as equals masters who had already made their mark, instead of being forced to mix with the crowd of turbulent young fellows who filled the ateliers—and almost from time immemorial the young Florentine artist had been very turbulent, in strong contrast to his quiet, timid and almost monastic *confrère* of Perugia and the provincial towns. "The gay and bright Raphael could not take offence at their pranks, so new to him; but it is more than credible that the elevation of his character led him rather to seek the society of cultivated and distinguished men—men who resembled that ideal of the perfect 'courtier,' with which he had grown familiar during his residence at Urbino." Very attractive is the picture of the young painter from Urbino, taking his part in the informal but celebrated discussions carried on by notabilities in the studio of Baccio d'Agnolo, architect and sculptor of wood. Among clusters of lesser lights were such luminaries as Andrea Sansovino, Cronaca, Antonio and Giuliano San Gallo, Granaccio and Michael Angelo, "sombre, taciturn, bilious, who only broke the silence to fling some sarcasm. Still, he was listened to respectfully, for though he was scarcely thirty, all Italy was full of his glory." On the other hand, Raphael was not yet a star of the first magnitude. During his four years' sojourn at Florence he only worked for amateurs of the second order. He received no commission for important monumental compositions. Civic corporations and religious communities patronized indigenous artists. The young stranger could only rely on those amateurs who from taste or economy preferred the easel picture to mural paintings. This circumstance, entirely fortuitous, controlled in a measure the nature of his productions. Chance frequently changes the direction of a whole school. These four years were more fruitful to him in lessons, in technical progress, than in material success. He rose rapidly to the rank of master, before the rich amateurs, the Rucellai, the Strozzi and others, were apparently aware of his existence. In vain we seek his praise in the literature of the Tuscan humanists, who lavish their titles of Zeuxis and Apelles on third-class painters. Nevertheless, Raphael was incalculably indebted to Florence. Without her solid instructions he never would have been the incomparable draughtsman, worthy to work for Julius II, for Leo X, and to found the Roman school.

It is not my intention to enumerate the list of pictures, chiefly madonnas, painted by Raphael during his long residence at Florence, and shorter stay at Urbino and Perugia prior to his departure for Rome in 1508. It has been, and will be, my purpose rather to note the causal agencies that specialized his talent, and made him Raphael. His madonnas of the Florentine period, the sweetest, purest, most graciously-beautiful compositions in their way that were ever conceived, form an absolutely distinct group in the work of the young master, who seeks therein to reconcile beauty with truth. Maternal tenderness, infantile joy, and a certain ineffable loveliness — the loveliness of domestic innocence — are expressed with such wonderful eloquence, that they render one oblivious of the dogmatic side of the subject. It seems as though the Divinity had left his exalted, mystic spheres, and descended to the earth, that he might idealize and hallow by his presence the calm delights of domesticity. Occasionally the consecrated attributes of Virgin, Child, or infant St. John are omitted; but they are never emphasized. A faint and linear nimbus alone symbolizes their divine nature. Constrained neither by the scruples of Umbrian patrons, nor by the demands of a pontifical court, Raphael gave free scope to his aspirations. He emancipated himself from all theological tradition—or rather he was one of a series of innovators. It would almost seem that he was an advocate for the "art for art's sake" theory. However this may be, his conscience would have revolted at the idea of sacrificing his art to confessional exigencies. He asked neither for rich stuffs, nor choirs of angels, nor sumptuous architectural framings, nor lustrous grounds of gold. Nature offered him material enough, the blue sky, flower-bedecked fields, placid streams, picturesque towns, and broken mountain lines. He was content to celebrate the beauties of nature — not as a tasteless naturalist, be it understood — to proclaim the grandeur of creation, and to glorify the purest sentiments, maternal and filial love. Surely may not such an art be properly called *religious?*

From the very inception of Christianity, and through all Christendom for many centuries, art had been the handmaid and adjunct of religion. In some communities, such as Mt. Athos, it is still so. As M. Taine observes, mere form did not suffice for the Middle Ages; it must represent some symbol, must designate some august mystery. All was pre-arranged: every detail had its familiar signification, even to the ignorant. The artist lost his independence, but was indemnified by popular sympathy. The Florentine naturalists of the fifteenth century were the first to demolish these venerable traditions. What could the resistance of an Angelico, or of the Umbrian school, avail against these strenuous pioneers, backed as they were by nature and the antique? Portraits supplanted the consecrated types of saints and apostles, and even their symbols were enforced to conform to artistic necessities.

Twice or thrice Raphael was tempted to sacrifice truth to dramatic fervor, as the Bolognesi sacrificed it in later years. He was not slow, however, to discover this temporary aberration, and rectify his course. His genius, healthy and robust, like that of the first Renaissance, abhorred an unnatural abstraction. According to his ideas, a figure should act logically, and conformably to its age, sex and character. "Therefore," says M. Müntz, "his children are always real children; swayed at times by a single sentiment, love for their mother, an ingenuous affection; but this sentiment is always in accord with those of childhood; is never artificial, never theatrical; nor does it ever weary us. This, if I am not mistaken, is the secret of the fascination that Sanzio's Florentine madonnas have exercised for more than three centuries; the secret of their eternal youth."

I do not fancy that M. Müntz would have us believe that Raphael made his studies from life without a *parti pris*. While it is undeniably true that these studies, as well as his finished figures, are remarkably free from false abstractions, especially when compared with those of his mediæval predecessors or academic successors, while it is patent that they live the life that is peculiar to them, never contravening the laws of nature; on the other hand they declare in every limb and movement pre-conceived ideas of elegance and grace. It would never have occurred to him to copy accidental, choiceless nature as do the men of to-day. Thus it is that his children, though replete with life, love, and truth of movement, are yet distinctly creations, undeniably the most beautiful, dignified, monumental types of childhood ever imagined; utterly different in their nobility from the pretty babies of modern holy families. There is nothing that I can think of since the days of Pericles that is more Greek either in feeling or method, though totally unlike in visible expression, than these Florentine madonna compositions of Raphael. They have that "easy, and frank nobility," that "noble naïveté and placid grandeur," the unequivocal characteristic of the marbles of the Parthenon, or the "Hermes" of Olympia. In these immortal works, abstract to a certain point, as ever art must needs be, nothing transgresses the laws of nature; but they represent a sublimated, not a hap-hazard nature. The painted figures of Raphael, like the statues of Phidias are sober, contained, and in a way sculpturesque, though not disagreeably and illogically so, as for instance the pictures of David and his school. M. Taine in a very just analysis observes that they *pose*. Yes, they do pose, yet neither affectedly as Perugino's heroes in the Cambio, nor as the Baroceo contortionists, but simply, beautifully, naturally, as an Olympic athlete.

Apropos of Raphael's drawings it is worthy of observation that there are none to be found corresponding, either in method or interpretation, to the modern life-drawing, which is, in reality, rather a painting in black-and-white than a drawing, in the strict sense of the word. There are innumerable suggestions from life in sanguine, pen-and-ink, or silver-point, many tentative and final sketches for frescoes or pictures, drawings more or less elaborate from the nude and draped figures, detail-studies of hands, feet and heads, but all treated subjectively — so, at least, it appears to me — that is with a voluntary, yet discrete, accentuation of the anatomy of the human form, with a due regard for the ulterior purpose of the study, and with a profound respect for style and elegance. It would be both pleasurable and profitable to study comparatively Sanzio's methods of drawing from life, as well as his picture-making processes, and our own; but my space-limit forbids.

There are those who blame Raphael for his constant repetition of trite subjects. "But such criticisms cannot bear examination, for it is easier to vary the subject than to vary the composition. To draw

from a single idea all the developments of which it is susceptible, that is the difficulty. Thus, to limit the programme, moreover, is to offer artists the opportunity of greater improvement. If the progress of the arts, either in ancient or modern times, is considered, it will be discovered that perfection has only been attained by the labor of whole generations testing their strength on a predetermined subject. The necessity of struggling in a circumscribed field, of directly attacking the difficulty, develops in every master resources unbeknown even to himself, and incites him to attempt a supreme effort." Raphael's problem was to make fresh combinations with two or three well-defined figures, the Virgin and the infant Jesus, and often, also, the infant St. John, or St. Joseph. To these were occasionally added others. Long before his time Giotto and Angelico had painted madonnas; but their forte was not the isolated figure. The former required vast wall-spaces on which to indite his epics; the latter accessory choruses of winged angels, adoring throngs of the blessed, or costly gold and ultramarine to perfect his conceptions of the divine personages. The Florentines of the latter half of the fifteenth century made great efforts to harmonize this simple subject — the madonna and child — with the new ideas. They suppressed all unnecessary accessories, and focused the interest on the principal personages, frequently giving the composition the form of a medallion. Nor should the contributions of the Venetians to the subject be ignored. About 1503 Michael Angelo painted his famous circular "Holy Family," a composition that manifested considerable progress. But notwithstanding this and the prodigious success of other valiant men, Raphael played freely and freshly with the same theme, imbuing it with a purity, grace, and classic beauty hitherto unimaginable.

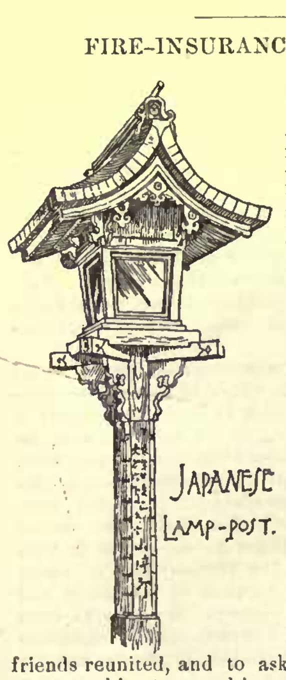
Before closing the chapter of Raphael's Florentine epoch, mention must be made of his first monumental work in fresco (1505), on the walls of San Severo in Perugia. Though the upper portion, by Raphael, is complete in itself, the lower part, left unfinished, owing to press of work, was completed in 1521 by the still-surviving Perugino, just after the pupil's death. Mention must also be made of the "Entombment" in the Borghese gallery — not that the picture is particularly sympathetic, but because it made a profound impression at the time, and marks a turning-point in his career. For the first time Raphael seems to have been desirous of emulating Michael Angelo, of showing his knowledge of the human body, and of solving the most complicated anatomical problems. According to Vasari, "he compared the muscular system of the *écorché* with that of the living model, and studied the diverse effects of its mechanism both on the separate parts and on the *ensemble* of the human body. He examined attentively, too, the articulations of the bones, the attachments of the tendons, and the network of the veins."

It is interesting to note the evolution of the "Entombment," the various preliminary and tentative sketches (one or two of the rejected ones are very beautiful in sentiment and linear arrangement), and his final adoption of Mantegna's scheme. But in spite of these excessive pains — and perhaps because of them — the picture leaves one cold. Such subjects as the scenes from the Passion were too antagonistic to Raphael's natural inclinations to be treated by him with entire success. His genius was too pure, too ideal, too Greek. Could he have invariably chosen his own subjects he would have banished from the domain of his art the expression of suffering.

Frederic Crowninshield.

[To be continued.]

FIRE-INSURANCE AND ARCHITECTURE.[1]


JAPANESE LAMP-POST.

SINCE the science of insurance is of recent origin, it would not be reasonable to expect that its development would have adequately covered all possible relationships. The extent to which these various adjustments have been already made is a source of wonder to every student of the subject, and at the same time a tribute to the energy and far-sightedness of the underwriters. But along the continually widening circle of your influence new problems present themselves, to whose perfect solution even your ability, if unassisted, is not fully equal. Among these none is of greater importance than the relation between architecture and fire-insurance. In one sense the relationship is of long standing. Alas that it has been so nearly a *status quo* of armed neutrality. To an architect the confession is humiliating but true, that we have certainly contributed our share to this estrangement, and as an architect I propose in this paper to make a straight confession, as is always best between estranged friends reunited, and to ask absolution. For if the relationship between architecture and insurance is to be perfectly understood and adjusted, it can be so only by concerted action between architects and underwriters.

The man who first drank the toast, "Here's to fires," may have been a witty toast-master, but there was something in the toast which suggested in an occult way that he was a witless architect — a hydrophobist with an even unusual hatred of water. He was a sort of Texas Flanigan in a late Republican convention. He was a kind of quickly-applied and swiftly-acting poultice, which draws out of us humors whose existence in the body of the profession we had scarcely suspected.

"Here's to fires" was a hilarious cow-boy whoop, which, like most cow-boyisms, grew out of a complex social drama in which the three villains were the house-owner, the house-builder and the architect. Of these three villains the architect was at once the most harmful and the most to be pitied. As always happens in new countries, it has been true that in America the services of an architect have until within a few years been largely regarded as a kind of luxury; and that his duty was of a purely decorative kind. As for the essential elements of most buildings, the builder was quite sufficient. But a question of rivalry with neighbors, a gratification of personal vanity, a yielding to the whim of wife or æsthetically-educated daughter, or some one else of the "women-folks" — these made necessary the otherwise unnecessary architect. It devolved upon him, therefore, to make a mere skin for interior parts furnished by the house-builder and owner. This epidermis was to be as "tasty" as the architect could evolve out of his inner consciousness, without extra expense to the owner; and, broadly speaking, "tastiness" was regarded as a merely feminine quality, any concession to which was a sacrifice of personal dignity rather inconsistent with a true American citizen. The architect, being held in this slight esteem, naturally took but slight interest in any but the æsthetic part of the building, and since but little money could be spared for this, it became necessary, for the proper advertisement of himself, and the even poetical execution of his design, to have recourse to all sorts of cheap material — wood, jig-sawed and otherwise, and that vilest of all vehicles of architectural expression, galvanized-iron. Thus questions intimately interwoven with the structure of the building fell into a secondary place in the architect's mind.

The slightness of service demanded from him, the smallness and uncertainty of his commissions, frequently drove him, for bread-and-butter reason, to unite the trade of architect and builder. This was the worst phase of the profession; for here not only was the architect for his own credit intent on making as much display as possible, but in this relation he had to deal with a contractor ready to make all posssible concessions to him, since each concession of solider construction was money in the pocket of the firm. Thus, from whatever point the question was viewed, the insurance companies were the sufferers, as all interests united against them. The owner was bent on ten per cent; the builder on more; the architect on great architectural creations rivalling those of Angelo or Delorme, but, for money reasons, in "American" and most inflammable material.

From this point of Arcadian simplicity great strides have been made. It may now be truly said that the better class of architects are ready to confess that best fidelity to his client, and consequent added stability in the building, mean the best interest of the insurance companies. We have learned, in short, that sound architecture begins at the point where a low-rate policy can be taken out. This being ideally true, it remains to find how it can become true in a wider and more general sense.

We assume that in the new and more confidential relation between architect and client, much can be done by the advice of the architect. In this matter the architect is primarily a professional adviser, whose technical assistance is directed toward purely architectural question; but he should be much more than this. He should assume the position of an adviser especially qualified by experience to suggest best methods of obtaining good interest from particular neighborhoods and especial classes of buildings; to demonstrate the degree of permanence necessary under each new condition, and in this and many similar ways to place at the service of his client his own larger experience of such questions.

Architects are much to blame whenever they are overridden by the mere caprice of clients in these essential matters of structure. Although there are fixed laws of taste and style in design, these laws are so elastic and their application so various that none but the craziest wish need lack architectural expression. But questions entering into the inner arrangement and structure of buildings are not to the same extent variable, and it is in these of all questions that an architect's greater experience should dominate the ignorance of his client. Very few laymen have the talent, knowledge or experience to make them self-confident in such matters. If in rare cases a thoroughly informed client knows more of them than his architect, then let the architect thank Heaven for an added source of knowledge, and "work it" for all it is worth. When, however, this ideal attitude is assumed between the planner and owner of the house, there must be potent arguments at the back of the architect, and these now and always will be money.

If the building be a dwelling, how much money does its owner lose interest on? To what advantage could he sell? What are to be his taxes and insurance? If the building is one for direct revenue, these and similar questions become more pertinent. Now of these inquiries the answer to one is in your hands, and the way in which you return that answer gives a direction to all the rest.

[1] A paper by J. W. Root, architect, read before the Fire Underwriters' Association of the Northwest, held at Chicago, September 8.

Have you not, in your eagerness to "do business," somewhat justified the attitude which people often assume towards you? Are the principles upon which you take out risks, and the examinations upon which your policies are based, so sound and careful that there lurks in them no invitation to that reckless indifference in house-builders which figures the insurance as part of the tangible value of the house?

Now, as in the past, the low-water mark of the cheapest building is exactly the high-water mark of your insurance rates; and the high-tide of thorough buildings is the low tide of your rates. Thus by governing to such large extent the interest of the owner, you determine the position of the architect.

I am confident that I speak for the best men in our profession when I say that we look for the time when you will be in all essential points the most unsparing critics of our buildings. Knowledge of this will only push us to better work and broader views; will add to the dignity of our profession, and incalculably strengthen our position with our clients. And this position of natural support and of friendly but thorough criticism, beneficent as it is to us, is of still greater value to the community at large.

In the large and infinitely complex social machine of which we are all parts, each independent action is productive of re-action throughout. Consider how deeply interwoven with the character of nations is the type of their houses. Well-built houses are the world over the best bulwarks to a national and individual conservatism. The family ties which have grown about some old stone dwelling are the firmer for its support: the commercial honor which has been housed within some venerable and time-defying warehouse is the keener and stronger for its walls and roof; the national or municipal pride which points to the hoary and weather-beaten hall where its liberties were born, holds those liberties the more sacred while that hall stands.

We, underwriters and architects, affected as deeply as we may be by our environment, have yet within our power to contribute to an almost equally deep influence upon that environment. To you a large part of the question seems to resolve itself into a wider range of rates, smaller at the top and larger at the bottom, making it very expensive business to build ill-considered fire-traps, and manifestly good "money sense" to build in the best way. In other words, to put into the widest practice that principle which has made it distinctly advantageous for capitalists to spend their money for such immense and indestructible buildings, as many which have been built in Chicago of late years.

I am not sure but action between underwriters and architects sufficiently concerted and prolonged may make it at least necessary to the existence of insurance companies that buildings shall present at least a superficial evidence of fire destructibility, while actually possessing the qualities of the Salamander.

This long-sighted as against the short-sighted policy is the service you can render us, and through us, yourselves.

Is it not time for the cessation in America of that most wonderful of all meteorological phenomenon — the simultaneousness of commercial panics and fires? Are we not as mere humanitarians interested to prevent, if in our power, those mysterious dispensations where a house goes off in smoke — cause supposed to be incendiary — loss complete — owner in anguish and tears — wear and tear of all the finer feeling beyond all money; loss of so many things about which the affections had entwined themselves — indignant resentment at impertinent questions — old rags and kerosene oil!

If it is a compliment to the innate rectitude of men that their youthful training makes villains of so few of them, is it not as great a compliment that the kinds of houses so largely occupied by them makes so few fire-bugs?

If we are now agreed upon this point in our relations to each other, let us pass to a rapid consideration of a few elements which enter into the construction of fireproof and non-fireproof buildings.

Of course we assume that the word "fireproof" is relative. He would be a bold man who would assert that any building could resist any conceivable fire. But we may assume as proof against all assault from all probable fires a type of building with which we are growing familiar. These, constructed with brick walls and iron well covered with fire-clay, with floors made of fire-clay arches, without galvanized-iron, wood or other destructible outside decoration; whose whole accessible structure in short has been made in the fire; these offer the nearest approach to absolute security from fire of anything since Mark Twain's coal mine.

But apart from these very costly structures designed to be absolutely fire-resisting, there is a large class of slow-burning buildings which when erected in large groups in a city, form a practically fireproof neighborhood, each individual building of which can be readily saved in case of fire. It is this class to which our attention should be more particularly directed. First let us glance at a few building materials, and then at their method of application.

Considered in their fire-resisting qualities, the first is fire-clay. This material has become of late years an invaluable adjunct to various classes of buildings, and it is safe to say that the near future will see it used in a vast number of directions now scarcely dreamed of. In its various forms it may be so cheaply made and so easily and inexpensively applied that there is no excuse for our relative indifference to it. It can be made in forms vastly lighter than brick, and consequently can be used in many cases where for reasons of support a brick wall is not possible. Moreover, being made in hollow or porous forms, its air-cells make it an ideal non-conductor of heat, and consequently but none the less valuable, an admirable "non-conductor of cold." On the cheaper methods of its application we will touch later in this paper.

Brick as the next of these fireproof materials must probably always hold its own. The cheapness of its manufacture, the ease and certainty of its use, the satisfactory artistic results obtained from its finer forms, all make it now what it was to the Romans, among the noblest of building materials. Terra-cotta is of course classed as brick, being in all respects a merely special form of brick, but better tempered in the clay, more carefully moulded and more thoroughly burned than most brick.

Iron has not held its own in the list of building materials. Of course we can't do without it, but it is always to be distrusted when freely exposed to the possible action of fire. Any high degree of heat in great measure impairs the efficiency of the material, or at best renders it liable to fracture under the sudden action of cold water. In the case of girders of wrought-iron, especially when exposed freely on three sides, the danger from heat is peculiarly great, because the tensile resistance of the metal is so much lessened. Even if under this weakened resistance of either iron beams or girders, the deflection is inconsiderable, it will probably be enough, in the case of girders, to drop the floor-joists resting upon them, or in the case of columns, to throw the direction of weight out of the axis of the column and so break or overturn it.

Many of our shop-fronts are built on iron girders carried across from post to post at the line of the second floor, and freely exposed. Here, although the chances are in favor of stability, yet the security would be greater, if these iron girders or lintels were covered with terra-cotta or fire-clay. If the iron lintels have no essential work to perform, as in the case of several of the newer large buildings, they may be safely left unprotected. For these and similar reasons iron cannot be regarded as an ideal fireproof material, especially when it is remembered how intimately connected all the parts of a building often are, and how fatal to the entire building may be the failure of one of its parts.

In all architectural work where iron has considerable weight to carry, it should therefore be protected from heat. The best thing for the purpose is probably some one of the various forms of fire-clay in common use. But when these are not to be obtained, or are for any reason too costly, a covering of asbestos in paper or fibre, or even of wood, provided the wood clasps the iron without intervening air-space (this condition is essential), is better than nothing.

The mechanical devices for applying fire-clay to iron may be obtained for reference from any one of the several firms engaged in this business.

Stone is now, as it has always been, the highest of all materials for building. Nothing can compare with it for the dignity of its expression and the facility with which it lends itself to all varieties of architectural expression. But regarded as a rival of iron in either its fire or time-resisting qualities, it must be conceded that it must take the second place.

Whenever stone enters very largely into the structure of a building, it is of the utmost consequence to know by actual test what is its action both under the direct contact of flame, and when suddenly cooled off by water. Nothing is stranger than the widely different performance of stone under fire; and I know of no means of predicting with anything like finality what a given kind of stone will do. Underwriters as well as architects are interested to see that all quarry owners furnish with their stone, not only tests of its water absorptive power and crushing resistance, but also of its precise action under great heat. Until this be known, absolute dependence on the integrity of a given kind of stone is unwise. This is especially true in walls faced with stone, and in piers of brick bonded with stone. In the first case, if the stone facing disintegrates under heat, the tendency is of course to make thinner places in the wall where this disintegration takes place, thus adding to the general tendency of the wall to fall outward. When, in the case of piers, the exposed edges of bond-stones are burned away, the efficient carrying area of the pier is reduced to a smaller and interior section, thus making it less safe, not only because of this diminished area, but also because few except such masons as built the wall of the New Jerusalem ever build the inside of a pier as well as the outside, and that part of the pier called upon to do the extra work is the part least able to do it. In all cases where stone, whose fire action is unknown, is used for piers, the pier should have considerable excess of size; and where such stone is used for wall-facing, the brick wall which "backs" it should be thick enough to all the work necessary for perfect stability without the stone.

Wood is, of all material used in building, that most generally understood. Any one who has, by slow and laborious degrees, learned to kindle a wood fire in an old-fashioned fireplace, knows by practice just how nearly fireproof wood may be. Wood, like paper, is very inflammable when cut thin and surrounded by an air space, but (always excepting certain highly resinous woods which burn under all conditions), when in large masses burns with comparative slowness. This peculiarity it was which made very slow burning a wood house constructed by the methods prevalent in England under Elizabeth and Anne, and in parts of New England in the early years of the last century. Wood, applied thus in large pieces, has the advantage over iron that the application of heat impairs its area only, without modifying the efficiency of the part which may remain, and the action of water upon it has no effect.

For these reasons it seems evident that for many purposes heavy solid wood posts and girders are preferable to a similar construction of unprotected iron — again assuming that we are not considering the few highly inflammable woods above mentioned.

Wood may also be protected by a number of cheap devices which greatly add to its efficiency. Preparations of creosote and other substances are made into fireproof paints, which are often treated by both underwriters and architects with neglect, because they do not do what they seem to profess — make the wood fireproof. But this they do not, or should not pretend to do. Their object is simply to retard combustion; and to sufficiently accomplish this is practically to solve the problem.

What has been said of wood has no relation to the use of it as we commonly see it, since, for reasons stated later on, the typical balloon-frame house, and the method commonly used in its construction, is just the principle used in the piling up of wood preliminary to a successful bonfire.

Asbestos is a material coming into larger use, from which we may expect results of importance. Whether used in fibre as a packing, or applied as a paper as an interlining, it is of very considerable value in retarding the progress of fire.

The same thing is true of such preparations of silica as "mineral wool," and of the substance called "fossil meal," and in an especial degree of plaster-of-Paris, whose use for fireproofing purposes is as general in Europe as it is rare here.

Two materials not yet in sufficient structural use to warrant an extended notice, but each possessing peculiar merits, are glass and paper. Glass is, perhaps, one of the most important of the building materials of the future, and its use will develop new applications of other materials for its protection from fire. Paper, in various compressed forms will also come into more or less general use, and will have the greater advantage that in bulk it burns very slowly, and that in its preparation for use it can be readily treated by chemical processes, so that it becomes nearly fireproof.

This is a slight sketch of the relation of a few familiar materials to fire. But more important than their inherent nature is the method of their use.

What are the most prominent reasons for the total destruction of buildings by fire? I do not doubt that any man of experience would answer: first, facility furnished for the rapid and unobstructed spreading of flames, which we may call "flues," and second, the falling out or in of parts of the burning building, which we will call "leverage."

First as to "flues." — It matters very little what a house is built of if only sufficient opportunity is provided for flames in one part to swiftly communicate with other parts without burning the intervening material. And yet, by a hundred ingenious devices these flues of communication are almost universally provided.

The typical American wooden house is generally constructed of light timbers set at small distances apart, and each timber has an open air-space on at least two sides of it, and often on three sides. The bottom of the flues thus constructed are frequently open, and generally open somewhere at the top; and in case they are closed at either the bottom or the top, the stopper is nothing more serious than a one-inch board, or one thickness of laths and plaster.

The same thing is true of almost all brick houses where, for reasons of cold and dampness, all inner surfaces of the walls have small wood strips set against them, to which are nailed the laths for plastering. This is, in America, the Universal Insurance-Company Extinguisher, Unlimited. Generally, the entire house is run through and through with these flues, which are by no means confined to outer partitions, but with almost equal frequency core out all the inner partitions as well. Then, having thus carefully provided a good circulation for the flames, the ingenious builder often provides a large shaft, or flue, open at both ends, and closed at each story only enough to make a good draught, and this large supplementary flue he calls an "elevator shaft," or "soiled-linen chute," or some other poetic and imaginative title.

Now, in all of these houses where is the fire first seen? Generally in the roof. Where does the fire start? Almost everywhere else. The bonfire thus carefully prepared has the peculiar merit of having each stick of wood provided with its own flue and draught; and the result is that the pile of sticks is at once burning at both ends. Is it cheaper to build this way? Not at all. The cost of the frills on one front gable or the crazy-quilt pattern of the stained-glass windows, would change the whole thing. The only care needed is, first, to make the flue as nearly fireproof as you can, and second, stop it up with something that will not burn. At the line of the various floors run out a board between the studs of the partitions, or between the furring on the brick walls. Fill up on this board two inches deep with the mortar left from the masonry and plastering, and the difference between this and the common form of wood or brick house is that this house, if it catches fire, can be saved; the other cannot. If the wood studs or furring strips have an inner-lining of asbestos paper, or an outer-lining also for wooden houses or partitions, the security is just that much greater.

The same flue system is generally carried through the floors of buildings, where the space between floor-joists from end to end is unobstructed. If this long space is cut into two or three fire-tight bulkheads by a piece of fire-clay tile or porous terra-cotta or brick, or, if there is nothing else, tin, the safety of the house is much enhanced.

Solidity is the measure of fire-resistance in a house; flue-idity is the measure of its fire-facility.

I can only allude to the principle involved here, which you will at once carry to its various conclusions.

Now, as to the question of "leverage." — Leaving out of question the ability of wall to stand alone and carry all the weight resting on it, the walls of buildings are generally forced over by some form of direct leverage. The floor-joists or beams generally have with the outer wall some fixed connection which, when the action of fire causes the joists or beams to fall down, holds them to the wall, forcing the wall to "buckle" and fall out and in. The action of this force, of course, depends on how heavily the floors are loaded. But the mechanical advantage of a weight thus applied to the wall for its destruction is very great; and it is a wall or partition of very great strength which will not yield to it. Falling under the application of this strain, the wall need not necessarily fall altogether inward; part of it may fall outward. Indeed, if the strain be applied at the extreme top, or even at the bottom, several reasons may make the wall fall both ways. With the precise action of this force we have now nothing to do; but it should be insisted upon by you that some method of anchoring wooden joists to walls be used of such character that the falling of the joists shall free this anchorage and leave the walls standing.

Over and above this point should be more carefully considered in the same connection, the mere lateral tying together of walls, so that it becomes more difficult for one wall to break away from another. This involves only a small matter of cost — a few pounds of ordinary hoop-iron well bonded into the walls being enough, but it often makes the difference between six and seven per cent in the yearly dividends of your companies.

The suggestions I have felt at liberty to make in this paper are very few; and I have endeavored, even at the risk of being commonplace, to be practical.

The essential element of the whole question of the relationship between architecture and fire-insurance lies very much deeper than any details of either architecture or fire-insurance. The relationship will be finally and happily adjusted at the moment when frank recognition of your interests by us is met by equally frank recognition and criticism of our work by you. The profession of underwriter cannot occupy its proper place alone. To give it its normal influence in the community — to insure its wider and deeper aims — it should enter with greater care and seriousness into the nature of the problems presented by that relationship we have been considering.

We, as architects, I trust you will find more and more willing to meet you half way in this adjustment; and the result of our mutual understanding and concerted action I believe must be of great good to the community.

A GEORGIA TURPENTINE FARM.

During a recent trip through southern Georgia I was most particularly struck with the varied and general utility of the yellow-pine tree. Besides, it is a very peculiar tree in many respects. If you cut a girdle one inch deep, continuously all around the tree, it will die. The circulation of sap seems to be between the wood and bark, entirely, and the fleshy membrane, which is the medium of circulation, is tough and leathery, separating readily from sap or bark. Let this be severed and the largest pine is killed. This sap contains a great deal of saccharine matter and sours readily, so that fermentation during summer is transmitted from tree to tree, the death of one frequently causing the death of quite an area around it.



GATEWAY AND TOWER.
A A Sketch Book, London. Rathenburg, Bavaria

A "lightwood," or "pitch" pine, is about as solid after death as before. First the straw turns yellow and drops off, then the bark is gradually cast aside, and finally all that softer shell of recent growth, which is called the sap portion of the tree, and there is left a tree of resinous pine, with its roots embedded in the soil, and the storms of many centuries may beat in vain about its gaunt, skeleton-like form. These lightwood trees are of vast use to the inhabitants. They

make an underpinning for buildings as solid as brick. There is nothing in the world superior as post material, and for any framework that is constantly exposed to the weather, this resinous pine is used. It is impervious to water, and never rots. Then they make tar and charcoal of this lightwood, besides its universal use as fuel and kindling-wood.

A turpentine farm must be seen to be appreciated. When a farm is first pitched, the boxes are cut one to three in a pine, according to size. The trees are counted into crops of so many thousand, and this is called a virgin crop. The queer little gauge called a buck is then brought to bear and a streak is cut above the box, which is simply a deep oval notch, pointing downward so as to lead the gum which exudes into the box below. These boxes are made to hold about a quart. This first run is as clear as oil, and is the finest of all. After being dipped out with a paddle, it is distilled, and the hard rosin left is sometimes as white and clear as glass. It is very beautiful, and brings a good price in the great naval-stores markets. Second year's gum is not as good in quality, but fully so in quantity. Third year boxes, when the monthly hackings have made the scar high up, are still poorer, and from then on the crops hardly pay for working.

Just about the roughest beings that ever cursed a country are some of these turpentine negroes. They are paid by the box, $1 to $1.50 per hundred for box-cutting, and furnished so much rations. The old rule was a peck of meal, seven pounds of bacon, and a quart of syrup. Other provisions the darkey must pay for himself. They are given shanties to live in, and there, amid filth and vermin, they sleep and eat. Sometimes they will get together nights and sing and preach and pray until after midnight, and then, at the call of the woodsman, they are up and going by early dawn. Saturday evenings at the station they congregate, and, where whiskey is obtainable, there are scenes of the wildest sort. That is what caused so many of those wire-grass counties to go dry. Liquor demoralized the laborers to such an extent that it was ruinous. There is not so much money in turpentine as there was five years ago, but men still manage to farm it.

The great lumber mills are what eat the beautiful forests away most rapidly. This fine timber is equal to any in the world in many respects. In carpentry now it is frequently put on in panels with the natural color and polish of the wood exposed. Millions of dollars are invested in the manufacture of rough lumber in the forests. Tramways are built into the woods. Stockades are built out there for mules and timber carts, and the great logs many feet in length are transferred to the mill where they are rapidly cut into squared lumber, plank, or scantling, and this is loaded on cars for some seaport, thence finding its way to all parts of the habitable world. At some of the larger mills planers are run, and there are a few that employ a force of skilled mechanics who plan a house complete, cut all the parts for it, and then ship it West, where the buyer has nothing to do but put it together by the plans and numbers which accompany it.

The rail-splitter and new-ground clearer are two great mischief-makers. An ignorant backwoodsman, with a sharp axe, will deforest many acres in one day. He frequently gets it into his head that he will clear a certain field. He goes and girdles the trees, gets too lazy, too poor, or too indifferent to complete the job, and the land lies there for years, and becomes an "old deadening" almost worthless as a farm, and entirely so as a forest. The rail-splitter cuts down trees indiscriminately, because they are so plentiful, splits what he can, and leaves the balance to rot, and thus aids in the destruction of trees that it has taken many centuries to produce, and that with all his wood-craft he cannot contribute to the reproduction of. It is strange, but true, that the second crop of yellow pine is not at all like the primeval growth. It is not so solid, so abundant in rosin, nor has it any of the good timber qualities of the original growth. Once gone the yellow pine is gone forever.

If not exposed to the weather the sap pine will last well. The log-houses are generally built of the sapling pines. They are long and straight, and when pealed carefully are of snowy whiteness. I noticed one old building that has stood the test of half a century, and it seems to be all right yet. This house is a fair sample of all the others of that day and time. It was built of logs, notched onto each other at the corners, the whole structure resting on two lightwood sills that lay on the ground. The roof was made of rough clapboards, riven out of bent pine, and the cracks and gables were ceiled with long strips drawn smoothly and nailed neatly on. The floor was of hard red clay, beaten into mortar, and then put down and packed until hard and smooth. Apertures were cut for the two doors, and the shutters were made of riven boards. The chimney was made of a layer of solid pine sticks, penned all round, then a layer of red-clay mortar, another of sticks and so on to the top. House and chimney are still standing, although a whole family of children have been born, grew up and married, and none but the aged pair who came there in the flush and heyday of youth are left to bear witness. There is a something about these pine trees that is wonderfully fascinating to me. I look up at their tall, trim, soldierly bodies and try to imagine how many lifetimes old they are. The dust of many generations of men must mingle around their strong roots. Could they but speak and tell of the scenes they have witnessed! Ah! they do speak, if you will but bend your ear to watch their low, soft whispers as I have done so many, many times. They have taught me things deeper than the love of the woods, and in my thoughtful moods I have found the sweetest enjoyment in the lonely companionship of their brooding silence. — *Atlanta (Ga.) Constitution.*

NOTES AND CLIPPINGS

The "Poor Sinner's" Bell at Breslau. — The city of Breslau celebrated the five hundredth anniversary of an occurrence which was memorable in the history of the town and is known wherever German poetry finds a home. The bell which hangs in the southern tower of St. Mary Magdalen's Church and is named "St. Mary's bell," but is usually known as "the poor sinner's bell," rang out morning and evening on the 17th of July to remind all who heard it that it was cast on that day 500 years ago. Next day (Sunday) the preacher reminded his congregation of the pathetic story which has made it singular among bells, how, when all was ready for casting, the bell-founder withdrew for a few moments, leaving a boy in charge of the furnace, warning him not to meddle with the catch that secured the seething metal in the cauldron. But the boy disregarded the caution, and then, terrified on seeing the molten metal beginning to flow into the mould, called to the bell-founder for help. Rushing in and seeing what he had intended to be his masterpiece ruined, as he thought, angered to madness, he slew the boy on the spot. When the metal had cooled and the mould was opened, the bell was found to be an exquisite work, perfect in finish, and of marvelous sweetness of tone. Coming to his senses, he recognized his bloody work and straightway gave himself up to the magistrates. "Blood for blood" was the law; he was condemned to die, and he went to his doom while his beautiful bell pealed an invitation to all to pray for "the poor sinner," whence its name. W. Muller has enshrined the sad story in a ballad of touching simplicity:

"War einst ein Glockengiesser
Zu Breslau in der Stadt."

— *London Times.*

The New Cemetery of Ste Marthe, Paris. — Paris population is making such progress that her cemeteries have become too small for her dead. A new necropolis will be opened in a few weeks, and an entirely new design introduced in the model and management of Parisian sepulture. Père-la-Chaise and Montmartre are very interesting from the great names that may be found on the tombs, but otherwise, a visit to them leaves a dismal impression on the mind. The cemetery, the ground of which has just been purchased by the Municipal Council close to Aubervilliers, will be laid out more after the English model. It will be a public garden, almost a park, planted with trees so as, so far as it is possible, to hide the tombs and monuments. It will be limited to contain 156,000 dead, but in France, unlike England, the right to the ground is limited to five years, so that the graves can only be sold for a strictly calculated sixty months. One strange innovation will make this cemetery of Ste. Marthe very memorable in the history of sepulture as conducted by the State. It will have no chapel. A "reception building" has been constructed, where the minister of whatever religion the dead belong to will receive the coffin, where the friends will assemble, where the last rites will be performed, and the funeral discourses will be pronounced. But though prayers will be pronounced in this edifice, its façade will display no cross, and no sacred inscription will be read upon its portals. It is strange that, as yet, we hear nothing in connection with this building about cremation. In Italy the Pope has discountenanced the practice, but the cemetery of Ste. Marthe is a secular building. The whole principle which guides its construction, its arrangement, and its management is in antagonism to the priest party, and yet this latest scientific institution provided for the old cemeteries finds hitherto no countenance in the new. There may, indeed, be changes before the first of October, the date of the first interment.— *Pall Mall Gazette.*

Remarkable Excavations at Jerusalem.—An interesting account is given in some Vienna and German papers of excavations made by the French Dominican monks at Jerusalem on some land which they have lately acquired, about a furlong and a half outside the gate of Damascus. Six metres below the present level of the ground the workmen came on some arches of considerable extent, the walls of which had been very carefully built. At a short distance they found the basement of a chapel, before the entrance of which there was a tomb-stone covered with a long inscription. Unfortunately, this stone was stolen before any one thought of copying the inscription, and no trace of it could be obtained. About the middle of their property they found a large, well-preserved mosaic, and upon the space all around being cleared the bases and other remains of great pillars were discovered. It is presumed that this is the site of the great basilica built in the fifth century in honor of St. Stephen by Eudoxia, the wife of Arcadius, the first of the long line of Eastern emperors. Still more remarkable is the discovery made just on the boundary of the estate. While digging the trench for the foundations of the boundary wall which the Dominicans wished to build the ground gave way, and one of the workmen disappeared. On clearing out the place they came on a large and beautiful hall, which had been cut out of the rock; where the rock failed the gap was filled by admirable masonry. From two of the sides two large doorways led into two vaulted tombs, all of equal size. On each side of the vault there was a resting-place for one coffin, and at the end opposite the entrance places for two. At the furthest end of the great hall a passage led to another excavated vault, in which stood three great covered sarcophagi. It is suggested that these sarcophagi contain the remains of Helena, Queen of Abiadenos, and her sons. The quantity of bones found in these chambers was very great. In the middle of the great hall in a hollow specially prepared, a sort of long metal box was found. It was adorned with representations of children holding garlands up on high. Unfortunately, there was no inscription, nor anything which could furnish a clue to the period or the purpose of these sepulchral chambers.— *London Times, August* 23.

The Sphinx and New Discoveries.— The Sphinx occupies a position where the encroachment of the desert is most conspicuous. At the present day nothing is to be seen of the animal except its head and its neck; but the old Egyptian monuments on which it is figured show not only the entire body down to the paws, but also a large square plinth beneath, covered with ornaments. Since the time of the Greeks, perhaps even since the reign of Thothmes IV, this plinth has disappeared beneath the sand, and its very existence had been forgotten. It is generally supposed that the Sphinx is hewn out of a large isolated rock, which overlooked the plain. But M Maspero's researches suggest that it is a work yet more stupendous. He has proved that the sphinx occupies the centre of an amphitheatre, forming a kind of rocky basin, the upper rim of which is about on a level with the head of the animal. The walls of this amphitheatre, whenever visible, are cut by the hand of man. It seems probable, therefore, that in the beginning there was a uniform surface of rock, in which an artificial valley has been excavated, so as to leave in the middle a block out of which the Sphinx was finally hewn. The excavations now being carried on will doubtless verify the existence of the plinth shown on the old paintings, and also furnish evidence, by the ornamentation of the plinth, of the true age of the monument. M. Maspero is inclined to assign to it a very great antiquity — possibly higher than the early dynasties, *i. e.*, than the first period of Egyptian history. As the result of last winter's work the sand round the Sphinx has already been lowered by about 30 metres.— *The Academy.*

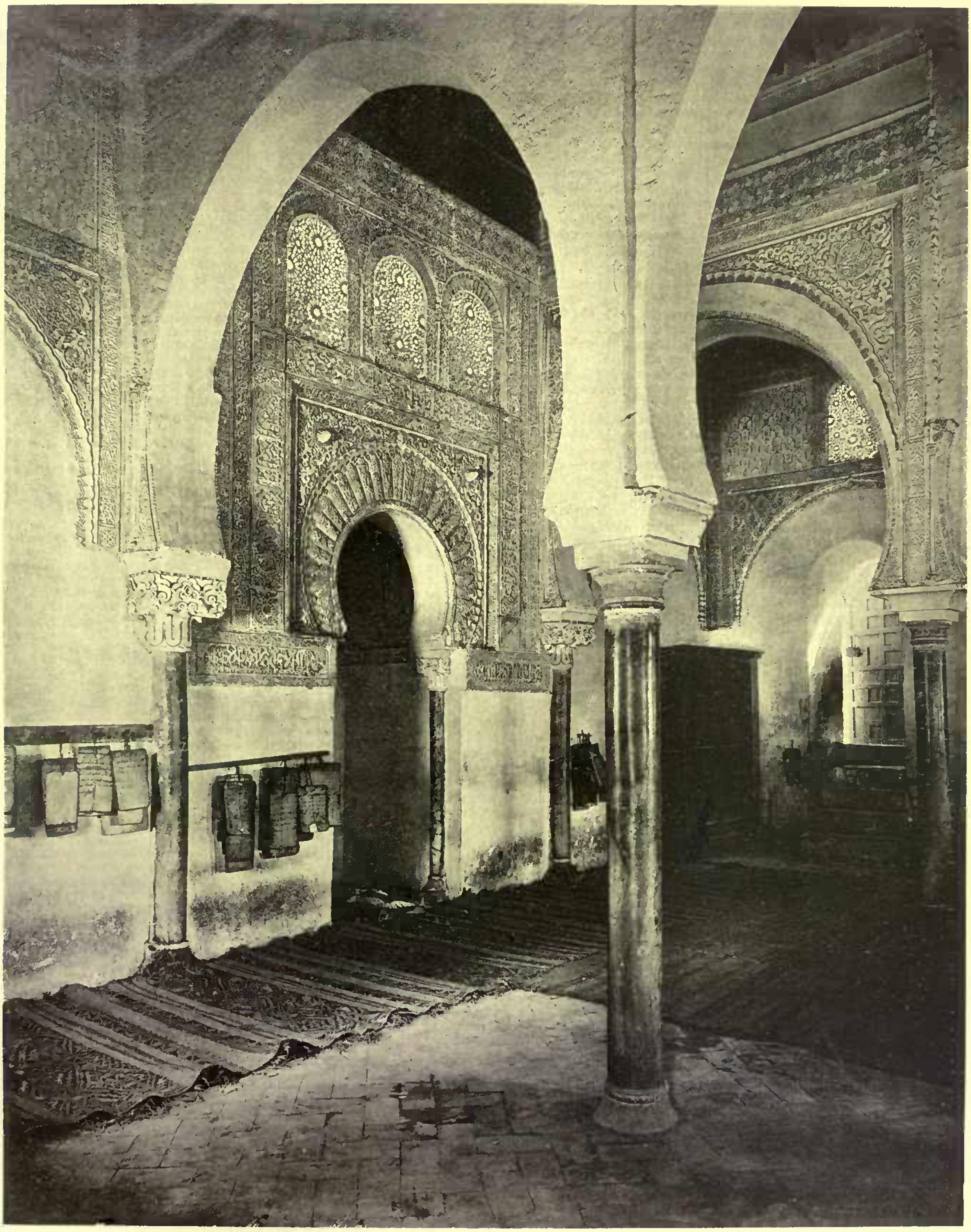
The Century's Rise of Wages.— Discussing wages, in one of his lectures before the students of Harvard University, Professor Thompson gives many facts of curious interest. In 1793 the Schuylkill and Susquehanna Canal Company advertised for workmen, offering $5 a month for the winter months, and $6 for summer, with board and lodging. The next year there was a debate in the House of Representatives which brought out the fact that soldiers got but $3 a month. A Vermont member, discussing the proposal to raise it to $4, said that in his State men were hired for £18 a year, or $4 a month, with board and clothing. Mr. Wadsworth, of Pennsylvania, said: "In the States north of Pennsylvania the wages of the common laborer are not, upon the whole, superior to those of the common soldier." In 1797 a Rhode Island farmer hired a good farm-hand at $3 a month; and $5 a month was paid to those who got employment for the eight busy months of the farmer's year. A strong boy could be had at that time in Connecticut at $1 a month through those months, and he earned it from working from daybreak until eight or nine o'clock at night. He could buy a coarse cotton shirt with the earnings of three such months. The farmers could pay no better, for the price they got for produce was wretched. Butter sold at eight cents a pound, and when it rose suddenly to ten cents several farmer's wives and daughters went out of their minds with the excitement. Women picked the wool off the bushes and briars, where the sheep had left it, and spun and knit it into mittens to earn $1 a year by this toilsome business. They hired out as help for twenty-five cents a month and their board. By a day's hard work at the spinning-wheel a woman and girl together could earn twelve cents. As late as 1821 the best farm-hands could be had for twenty-five cents a day, or twice as much in mowing time. Mathew Carey, in his Letters on the Charities of Philadelphia (1829), gives a painful picture of the working classes at that time. Every avenue to employment was choked with applicants. Men left the cities to find work on the canals at from sixty to seventy-five cents a day, and to encounter the malaria, which laid them low in numbers. The highest wages paid to women was twenty-five cents a day, and even the women who made clothes for the arsenal were paid by the Government at no higher rates. When the ladies of the city begged for an improvement of this rate, the Secretary hesitated lest it should disarrange the relations of capital and labor throughout the city! Poor people died of cold and want every winter in the city, and the fact seems to have made an impression only on benevolently disposed persons like Mr. Carey.

Fog Ponds.— Many of the archaic methods which met the requirements of ruder ages have, from their simplicity, efficiency and economy, continued in use amidst the improved conveniencies of modern science. Dependent as were the men of other days upon the phenomena of nature more directly than in our times, they found many ways of increasing the benefits thereby obtained, which are still in use and likely to be so until the end of time. Water-supply for flocks pastured on wide chalk-downs would appear a peculiar difficulty; far from streams, high above water-bearing strata, too remote from any publicly-organized system; nevertheless, the fog-pond has supplied the sheep farmers of many a dry down with necessary water. Gilbert White, writing in 1776, remarks: "To a thinking mind few phenomena are more strange than the state of little ponds on the summits of chalk-hills, many of which are never dry in the most trying droughts of summer. We have many such little round ponds in this district, and one in particular on our sheep-down, 300 feet above my house, which though never above 3 feet deep in the middle, and not more than 30 feet in diameter, yet never is known to fail, though it affords drink for 300 or 400 sheep, and for at least 20 head of large cattle beside." The simple operation of making a fog-pond, as noticed on the downs near Worthington in the summer of 1881, is as follows: The selected spot, on the slope (in this case almost at the summit) of the downs is unturfed, the turf removed, and the chalk dug out to form a saucer-shaped depression, the surplus chalk being deposited on the lower side, forming an embankment. Water is then thrown on the bottom, and a horse, harnessed to a small implement having several wheels something like those of a clod-crusher, is walked round and round, thereby working the whole of the invert into a slurry. This operation is continued for three days, the horse and wheels going their monotonous round deep in the white mud, which, when sufficiently worked, is dressed to an approved segmental shape and forms a retentive basin, not liable to crack, like a clay lining during dry weather. The supply is, to some extent, assisted by storm water running down over the saturated turf, but its chief source is atmospheric moisture, which condenses in quantities marvellous to those who have not noticed the fact. The before-named naturalist observes: "Hence we see that the air, when loaded with fogs and vapors, and even with copious dews, can alone advance a copious and never-failing resource." The working of the chalky bottom was formerly done by the feet alone, of horses or men, and the whole process is still carried out in a traditionary manner by the local peasantry of those districts where fog-ponds are used.— *The Builder.*

TRADE SURVEYS

The greatest source of danger just now to the improving commercial and industrial situation is the probability of overproduction. Overproduction ought to be impossible as long as reasonable human necessities are not provided for in the shape of food, clothing, house-room, and a surplus sufficient to meet the reasonable demands of taste. The capacity and willingness to labor is sufficient to meet these demands and much more, but the faulty distributive agencies employed create, at frequent intervals, an apparent but grossly deceptive over-production, which reacts disastrously upon all interests. It would be a grand step of progress to overcome this difficulty and to establish the harmony between productive and distributive agencies. This is the coming social and social-economic problem. It underlies nearly everything in the world of business and is the secret power and force behind labor organization and commercial and industrial competition. To sell all that can be produced is the question, the problem. There is a place, a demand for all that can be produced, but the selling of this possible production is impossible under existing systems. Anarchists and socialists are the illegitimate product of an insane endeavor to forcibly right the disorders, if such they are, which prevent that harmonious distribution which will permit the fullest activity of productive agencies. The agitation is world wide. The Royal Commission in Great Britain has been endeavoring to furnish a scientific diagnosis of the case. The Governments of Europe prefer to furnish an antidote in the shape of costly military establishments. Employers and employed on this side are seeking, by organization, to establish better conditions and relations, by which the pent-up energies of labor can be more regularly employed. There ought to be no such difficulty, and why there is one is not easily to be explained, except that it is the order of nature which obstructs the pathway of human progress by an endless succession of difficulties in the overcoming of which lies progress and development.

Just now all productive agencies are engaged beyond average activity. The depression in cost of production during the past two or three years has paved the way for present results. The rich are making less and the poor are making more. The volume of loanable capital is relatively increasing and its cost for use is declining, while the compensation of labor is increasing. Banking institutions are springing up in Western States, attracted thither by the more remunerative rates. The movements in financial channels within two or three weeks confirm previous observations concerning the migratory character of capital. The railroad, the manufacturing and the building interests find much stimulus in this tendency. The smaller cities and towns feel the effects in building activity. The people are instinctively following up organization to secure by united action what is individually impossible. Building associations, beneficial organizations for insurance purposes, trade organizations for regulating production and competition, are all multiplying, especially in the Western States. Since September 1, a fresh impulse seems to have been imparted to small house building, especially in manufacturing localities in Ohio, Indiana, Illinois, Iowa, and two or three Northwestern States. Lumber authorities make special mention of a large distribution recently in those States, and of such a degree of inquiry as is likely to ensue more satisfactory prices for building lumber. People have practiced not only a commendable economy, but have developed business talent and foresight which has resulted in a conservation both profitable and wise. Real estate is holding its own everywhere. Equalizations are going on, in values. Rents are adjusting themselves. In some places they have declined, and in others have advanced. There are none of the wild values of a few years ago. Stocks are steady. Dealings are legitimate. Purchasers are purchasing to hold rather than speculate. The lumber interests anticipate an unusually good winter. The Southern yellow-pine interests aim at more harmonious working hereafter. The lumber manufacturers of the Northwest met at Chicago on Thursday. The aim of this association is to regulate log and lumber production. It has exerted much less influence than circumstances demanded and just now it should raise its united voice against a winter overcrowding of mills. All large cities and towns throughout the West and Southwest are consuming immense quantities of mill products. Business in lumber has improved throughout the Middle and New England States. The possibilities of a shortage of logs and lumber has had a good effect in stimulating backward buyers in almost all markets. The output of mills in all sections is being steadily disposed of at good prices. All Atlantic markets are in good shape. Hemlock in Pennsylvania has advanced on account of low water and spruce is threatened with an advance in New England markets because many water-mills are shut down. Yellow pine is in fair supply, but not abundant, and commands good prices. There is a toning-up of prices at New York and Philadelphia just sufficient to impart a vigorous feeling to the market. In planing-mill work orders are being crowded through. The iron and steel industries are still gaining. Business is abundant. Bridge-building contracts for large quantities are soon to be placed; in fact, last week three thousand tons of material were contracted for in Pennsylvania mills. The coming year will be an important one to bridge-builders. Merchant bar-iron has advanced $2 per ton for refined, but medium is steady. Common is higher because of $21 to $22 old iron rails. Steel rails are $34 for spring delivery and $35 for winter. Merchant steel orders are crowding mill capacity and pig-iron demand is preventing any accumulation of stocks. Wrought-iron mills have more business engaged than can be executed before frost. Nail production is curtailed at Pittsburgh, but elsewhere is up to maximum capacity. No restriction of production is thought of; on the contrary, all energies are bent to expansion. All consumers are buying with activity and confidence, and makers are barely able, even at the present unprecedented rate of production to keep even with demand. As previously remarked, this activity may lead to too great output, but the probabilities are not so great. Steel is supplanting iron in all directions. The industrial outlook is certainly attracting much capital, but as a more equitable distribution is effected, the permanency of the demand is more and more assured. The autumn and winter months will be months of heavy demand, firm prices, and extension or capacity in all the greater and most of the lesser industries, and by the opening of spring the crisis will have been reached.



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INTERIOR OF A MOSQUE AT TLEMCEN, AFRICA.

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CONTENTS

THE formal announcement has just been made by M. Lockroy, the French Minister of Commerce, that a Universal Exposition will be opened in Paris on the fifth of May, 1889, and will be closed on the thirty-first day of the following October. The principal exhibition buildings will be situated on the Champ de Mars, extending from the Military School to the river, but supplementary buildings will be placed, if necessary, in the Esplanade of the Invalides, and along the quay which connects this with the Champ de Mars; and on the right bank of the Seine the Palace of Industry, and the available portion of the Trocadero Palace, with the gardens attached to each, will be utilized for certain departments of the great fair. Although much opposition has been made to the occupation of the Champ de Mars, the largest open space remaining in Paris, for the exhibition, there is no doubt that, so far as strangers are concerned, it offers by far the most convenient situation in the city. Under the arrangement now decided upon the foreign visitor, instead of being obliged to go every day in a crowded railway train to one of the many suburban villages which were proposed as suitable sites for the exhibition buildings, will need only to walk from his hotel in the Rue de Rivoli, or his lodgings in the Boulevards, across the Place de la Concorde, to find himself at the entrance of the Palais de l'Industrie, which is very likely to contain an exhibit of fine arts, while its garden, close by, will probably be utilized for the best of the horticultural displays. From this garden he has only to cross a bridge to find himself at the entrance of the Invalides enclosure, where other departments will be placed, and when he has completed his inspection of these, a short stroll along the river bank, which will be lined with novelties in the way of buildings, will bring him to the Champ de Mars, the central point of the exhibition, immediately opposite which is the Trocadero, with its garden. For those who prefer to lodge at a distance, the Seine steamboats will furnish convenient transportation to several points in the group of buildings, and tramway cars and omnibuses will carry those who prefer to travel by land.

THE general direction of the Exposition is in the hands of the Minister of Commerce, who will be assisted by a council of three hundred members, divided into twenty-two commissions, each of which takes charge of a certain part of the work. For receiving and taking care of exhibits, special committees are to be appointed. In France, each territorial department has its own committee, which is expected to do what it can to interest local manufacturers and artists in the exhibition, and to receive and take care of their goods; and foreign nations are expected to appoint similar commissions, to see to the interests of their own countrymen. Those who are disposed to exhibit are allotted space in the buildings or grounds free of all charge, and, if they wish it, are supplied gratuitously with steam-power, water and gas, but they must furnish their own cases or shelves, and, if they wish for power, they will have to bring it with their own belts or gearing from the main shafts to their machines. The general catalogue, in French, will be published by the Administration of the Exposition, and no other catalogue in French will be allowed to be sold, but foreign nations will be permitted, through their commissioners, to prepare and sell catalogues in their own language of the exhibits in their section. So far as possible, protection will be given to inventors and designers, by forbidding the sketching or photographing of any object without the written permission of the person who exhibits it, countersigned by the Director of the Exposition; and certain guarantees against piracy are afforded, under a special law enacted for the purpose. The exhibition buildings will be constituted official warehouses, and the goods displayed in them may be brought in free of all customs or *octroi* duties. Among the works of art, which most interest us, will be admitted paintings, drawings, sculptures, architectural models, drawings, designs and restorations, medals, engravings and lithographs, by native or foreign artists, executed since May 1, 1879. All drawings and paintings must be framed, and a special jury will make the selection of those to be admitted. Where the objects exhibited are samples of regular manufactures, it is earnestly requested that the regular price should be marked on them, not only for the information of the public, but as an element in the estimation of their merit. Much pains is apparently to be taken to have the collection of methods and appliances for education, particularly of technical education, as full as possible, and this will undoubtedly be one of the most valuable portions of the exhibition, but many other portions will be of great interest, even to those without special knowledge of the subjects which they illustrate. Whether, as there is some reason to fear, international animosities and distrusts will interfere with the comprehensiveness which should give its principal value to the exhibition, remains to be seen, but it is said that the Germans, who rather rudely refused to take part in the last affair of the kind in Paris, have had reason to repent of their ill-humor, and if they will set the example of cordial co-operation with the most amiable and hospitable nation in the world, in its great love-feast of peace and prosperity, they will certainly do themselves no harm, and will help materially to enlist the interest of other people, to the mutual advantage of all.

IN the present state of knowledge, it may be assumed as proved that typhoid fever and poisoning from drains or vaults are inseparably connected, and the man who lives in a town supplied with good sewers is, on an average, less than half as likely to be afflicted with this dreadful disease than one who is obliged to dwell among cesspools. Even after the soil of a city has become irreclaimably foul, as it is in nearly all large towns, a change in the system of disposal of refuse, by which the addition of new pollutions to those already existing is avoided, is always, as it seems, followed by an abrupt diminution of the death-rate from typhoid fever and kindred diseases. The comparison and compilation of health statistics, with their relation to circumstances of drainage and ground-water, is as yet hardly begun, but the *Revue Scientifique* gives a few data in relation to the larger European towns which are interesting. According to these, the abolition of the system of depositing house wastes in large *fosses* or cesspools, to remain there until removed by the public authority, which was until within about twenty years almost universal in Continental cities, has been already followed by surprising results in diminishing the mortality from all causes, but more particularly from typhoid diseases. In Berlin, where the first attempts to improve upon the old system were made in 1875, the total annual mortality has been reduced by nearly one-fourth, while that from typhoid fever is now about one-half the average of the years preceding the change. In Brussels, where cesspools were replaced by sewers in 1870, the mortality from typhoid fever fell at once to about one-third of its former proportion, and the improvement continued, perhaps by some gradual amelioration of the condition of the soil, so that the rate now is little more than one-fourth of the old average. At Frankfort nearly similar results were obtained, and in London, which, as a sewered city, is usually compared with Paris, where most of the house wastes are still received into

cesspools, the annual number of deaths from typhoid fever, out of each one hundred thousand of the population, is twenty-six, and from diphtheria eighteen, while, out of the same number of persons in Paris, seventy die every year from typhoid fevers and seventy-five from diphtheria.

A NEW mode of treating clay for use as a water-proofing material has, according to the *Builder*, been devised by Mr. Thomas Fraser, of Aberdeen, a gentleman interested in the manufacture of bricks and tiles. It is usual in puddling with clay, to prevent the penetration of water, to place the clay in trenches, or between rows of sheet piling, in a plastic condition, mixing it first with water, and tempering carefully before using. It occurred to Mr. Fraser to test the permeability to water of clay tempered with various proportions of water, and he found that when mixed with all the water that the solid mass would take up, the clay was easily penetrated by liquids. It appeared also that as the clay absorbed moisture, it increased in volume, and he reasoned from this that conversely, if the volume were prevented from increasing, absorption would be restricted, and the clay might be maintained with certainty at such a point of moisture as to have its maximum resistance to penetration by water. In order to accomplish this result, it would only be necessary to put the clay in place in the form of fine dry powder, packed in so tightly as to be incapable of absorbing more than a certain percentage of water. In practice, Mr. Fraser proposes to reduce the clay to very fine powder, and pack it into the trenches in the ordinary way. So treated, it is found, when the water is allowed to reach it, to absorb about thirty-five per cent of its weight, but the expansion due to this compresses the mass so much that it remains impenetrable.

MOST people think that Paris is, above all others, the city of fireproof construction, and it is indeed rather surprising to find that in a place where cellar ceilings are almost always vaulted in brick or stone, while floors are usually laid with iron beams, and stairs are commonly of stone, the number of fires is, for the population, almost equal to the average number in New York, the total number for 1885 having been twenty-five hundred and thirty-eight. Although the usual Paris construction, when subjected to an intense heat, often fails completely, as it did on the occasion of the burning of the great dry-goods store known as the *Printemps*, which was a mass of ruins in an hour after the breaking out of a fire among the goods exposed for sale, it resists a small conflagration for some time, and we find that three-fourths of the fires of 1885 were of slight importance, and that only twelve resulted in serious loss, the total damage from all the fires being estimated at a little over a million dollars. The force of firemen on duty numbers seventeen hundred and forty-three, while that of London, a city of twice the size, and, as a rule, much less solidly built, contains only six hundred and sixty-nine men.

LIKE most agricultural countries in Europe, France often suffers from late spring frosts, which destroy the young vegetation, and do a great deal of mischief. It has been seriously proposed of late to guard against these by building fires about the fields, with the idea that the warmth would avert the frost. There is no doubt that they would be effectual, if there were enough of them, but some late inventors, more scientific than the rest, remembering that such frosts never occur on cloudy nights, for the reason that the clouds prevent the radiation of heat from the earth, and the consequent chilling of the ground, proposes to combine the warming effect of fires with the production of artificial clouds, which he thinks would, like natural clouds, assist in preventing radiation from the ground, and consequent freezing. The method for accomplishing this result devised by the latest of these investigators, M. Salvat, consists in placing about the fields to be protected what might be called cartridges, consisting of truncated cones, formed of a mixture of pitch, rosin, oil, coal-tar, bits of wood and combustible rubbish, all mixed with earth. These cones stand on three short wooden legs, and a hollow in the base contains a bunch of shavings, soaked in coal-tar. The material of the cones being water-proof, they may be exposed to the weather for an indefinite period without injury, and the shavings for kindling, which need to be kept dry, are protected by the mass about them, so that they can be lighted at a moment's notice, in any sort of weather. The materials burn with a great deal of smoke, and a row of twenty or twenty-five cones, placed on the north and east sides of a two-acre vineyard, on the quarter from which the cold winds come, as they do with us from the north and west, is found sufficient to ward off any ordinary spring frost. The only objection to the plan would seem to be in the effect of the smoke on tender vegetation. Few things are more injurious to plants than the vapor of coal-tar, and the young shoots of vines are particularly sensitive to noxious influences.

THE *Revue Industrielle* speaks of a new device for electric signalling at sea which promises to be useful in practice. Every one knows that the ordinary communication, by means of flags, which takes place between vessels passing within sight of each other by daylight, is often of great importance to their owners, and as nearly all first-class steamships now utilize a part of their surplus power in electric lamps, it is natural enough that some attempt should have been made to employ these as a substitute for flags for night signals. The earliest method invented for the purpose depended upon the variations of current in an incandescent lamp; but the light of these is hardly bright enough for the purpose and the changes in intensity of incandescence take place rather slowly, so that the most recent system, which employ arc lights, seems likely to be much better. In this system, which is due to Mr. Kalezowski, of Berlin, an arc light is fixed to the mast, and supplied by a dynamo-machine under the control of the engineer. On its way to the lamp, the current passes through a Morse instrument, supplied with a band of paper, and the signals transmitted by the lamp are by this means copied, so to speak, on the paper, which serves as a permanent record. In certain cases, particularly in naval manœuvres, this record would be of great value, and it is to be hoped that the new invention will prove simple enough for ordinary use.

ABOUT three thousand people in Albany, including a great many who will find it hard work to save up enough money before cold weather to carry them and their families through the season of frost and enforced idleness, were, at last accounts, learning something from that harsh but thorough master, Experience, in regard to the pleasures and advantages of interfering in other people's quarrels. It seems that certain local manufacturers of building materials, bricks and cement being more particularly mentioned, had thought fit to employ men in their works who did not belong to those degrading associations known as unions. After their usual cruel and cowardly fashion, the petty tyrants who drive the unions undertook to find means to ruin the manufacturers who disregarded their orders, and to starve the families of the men who declined to become their slaves, and with this object they conspired with the managers of the unions existing among workmen in the building-trades to force the master-builders of the city, by threats of ordering a general strike of their men, to refrain from buying any bricks or cement made by the proscribed manufacturers. It is hardly necessary to say that men who possess sense and courage enough to carry on a contractor's difficult business are not likely to be much pleased with the proposition that they shall allow themselves to be used as cats-paws by a few vindictive rascals to ruin their own friends, and the Albany builders, finding that they must accede or fight, unanimously chose to fight, and, following the modern maxims of war, which point out the advantage of carrying on a campaign in the enemy's territory, rather than in one's own, they not only replied to the demand made upon them by a refusal, but gave notice that unless the boycott against the offending brick and cement manufacturers were formally removed before a certain day, they would themselves, on that day, discharge all their union workmen, and suspend building operations. The appointed day arrived without any appearance of concession on either side, and the contractors, true to their word, closed their offices and stopped work. As the interest of the chief boycotters evidently lay in prolonging a struggle which brought them into prominence, and there was no reason to suppose that they would show much consideration for those who had meekly followed them into the fray, the more capable and independent among the men packed their tools without delay, and started for New York and Charleston, where they knew that they would be tolerably sure of employment at good wages until the agitators came after them, bringing with them their train of discord and misery.

EARLY SETTLER MEMORIALS.[1] — II.



John Bridge, Cambridge, Mass. T. R. and M. S. Gould, Sculptors.

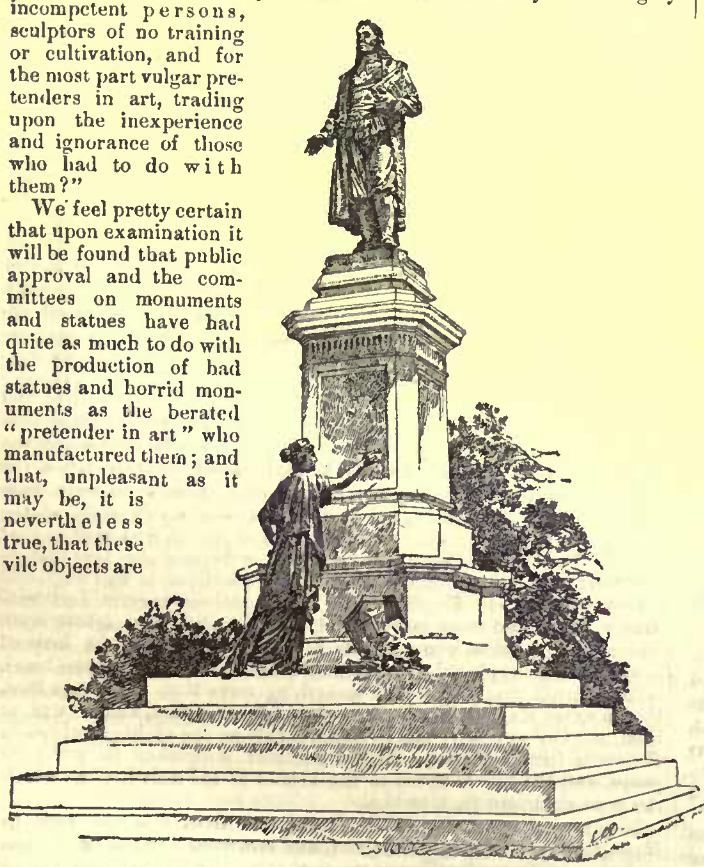
WE have spoken at this length of "the Pilgrim," on account of the representative circumstances of its erection, the reputation of the sculptor who made it, and particularly with reference to a passage in the article in *Harper's Weekly*, already quoted from, wherein it is stated, in claiming due appreciation for "the Pilgrim," that "it has been the fate of an appalling proportion of all the public sculptures in this country — and the war was prolific in such memorials — to fall into the hands of thoroughly incompetent persons, sculptors of no training or cultivation, and for the most part vulgar pretenders in art, trading upon the inexperience and ignorance of those who had to do with them. There has been more to blush for in the practices and the productions of our sculptors, working at home or in Italy, than in all the shortcomings of all the other art of the country put together."

These words may be taken as representative of many similar expressions of reproach, which have appeared in the past few years in influential newspapers and magazines. It has become quite the fashion to berate the "pretenders in art," the "art-contractors" and the "builders of ungainly monuments," and to lay the entire blame for the multiplicity and inferior quality of these objects at the doors of this class of unnamed persons.

Is public sensibility so dull that comparison with such stuff is necessary in order to demonstrate the merits of "the Pilgrim?" There was a time in this country when the "Greek Slave" gained in public estimation by the assertion that it was "superior to Greek sculpture," and when a piece of white marble resembling the form of a nude female, though possessing in its execution nothing but the grossest ignorance and pretence. was accepted as a masterpiece of sculpture. We supposed this time was past.

Who is responsible for the "appalling proportion of all the public sculptures in this country" that have been made by "thoroughly incompetent persons, sculptors of no training or cultivation, and for the most part vulgar pretenders in art, trading upon the inexperience and ignorance of those who had to do with them?"

We feel pretty certain that upon examination it will be found that public approval and the committees on monuments and statues have had quite as much to do with the production of bad statues and horrid monuments as the berated "pretender in art" who manufactured them; and that, unpleasant as it may be, it is nevertheless true, that these vile objects are



The Roger Williams Monument, Providence, R. I. Franklin Simmons, Sculptor.

just what the people wanted; that they exactly gauge the prevailing public taste; that the existence, success, and constant increase of these "incompetent persons," contractors and accomplished business manufacturers of art, are the legitimate results of this taste, if taste it can be called; and that they owe their present active encouragement to the same cause. It will also be found that these things are as true of one locality as another — of cultured Boston, with its background of art history, and its eminent representatives of art activity, as of some unfamiliar hamlet in the mountains of Maine.

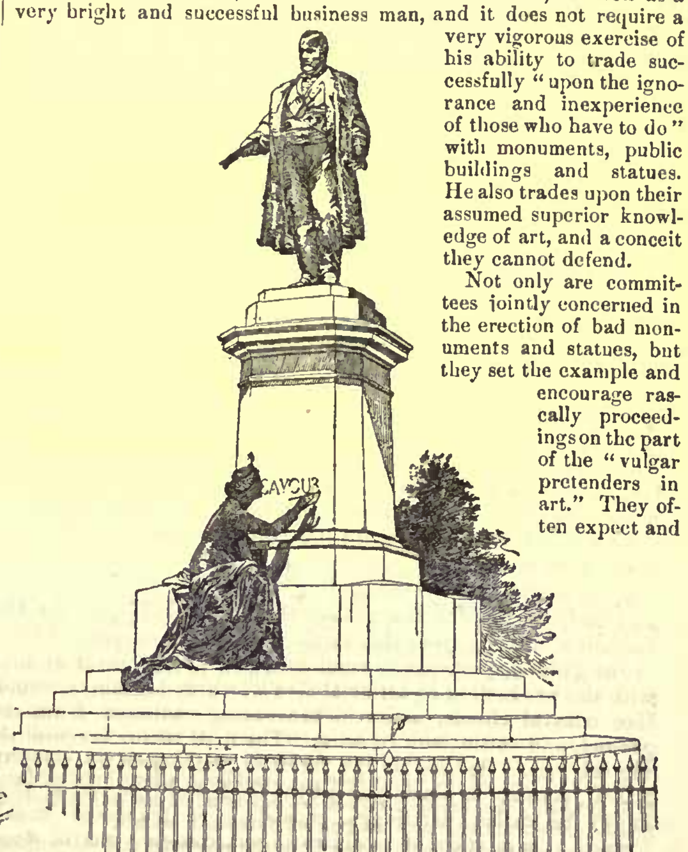
Who are these simple souls who have been imposed upon and deceived by the "vulgar pretenders in art?" Are they the honest and credulous dwellers in the rural districts, who have never seen the mighty masterpieces of the ancient worlds, but owe all they know of sculpture to an occasional glimpse of one of John Rogers's groups, and to whom the single visit of some image-maker is sufficient recommendation to give an order for a soldier's monument? Or are they the leading citizens of their respective localities, men who have travelled abroad, and have been familiar all their lives with illustrations and copies of the best ancient sculpture, and are not strangers to the best art of to-day; men who boast of their knowledge of art, of their superior capacity for judging it, and who talk long and loud upon the progress it has made during their precious lives? We think these are the very men who are jointly responsible, with the public to support them, and the art-contractor to be manipulated, for the very large majority of the wretched sculptures that have been made for the past twenty years in this country.

Are these men so innocent and blind, so fearful of public condemnation, that they fall an easy prey to the monument hucksters who go about the country deceiving them? We fear not. They understand the situation; they fear no reproach, they ask for no excuse, especially on the score of inexperience and ignorance, and they gain nothing by experience. They are not so simple and ignorant of the ways of the world as might be supposed; on the contrary, they show an adroitness that serves them perfectly. They clothe themselves in an armor that is hard for the critic to penetrate. For they seek the advice and support of artists and "experts" to confirm their decisions, and they do not seek in vain. The progress of art, like other important movements, often finds its worst enemies in its own household. The best help the inexperienced, as well as the long-practised committee-man on monuments and statues receives, is that which is made known in this significant sentence: "The design has been examined and approved by many of the best artists."

Instances in proof of all this are too numerous to mention. To say that "incompetent persons" are able to trade upon the "inexperience and ignorance" of leading citizens, in matters of art as well as business, implies that the former are superior to the latter, a credit not always deserved. If it is true, then the first are unjustly named, and the last are not as wise as they ought to be.

It is a fact that in many instances the so-called incompetent person, the art-contractor, is "the smartest man in town," as well as a very bright and successful business man, and it does not require a very vigorous exercise of his ability to trade successfully "upon the ignorance and inexperience of those who have to do" with monuments, public buildings and statues. He also trades upon their assumed superior knowledge of art, and a conceit they cannot defend.

Not only are committees jointly concerned in the erection of bad monuments and statues, but they set the example and encourage rascally proceedings on the part of the "vulgar pretenders in art." They often expect and



Monument to Count Cevour, Milan, Italy.

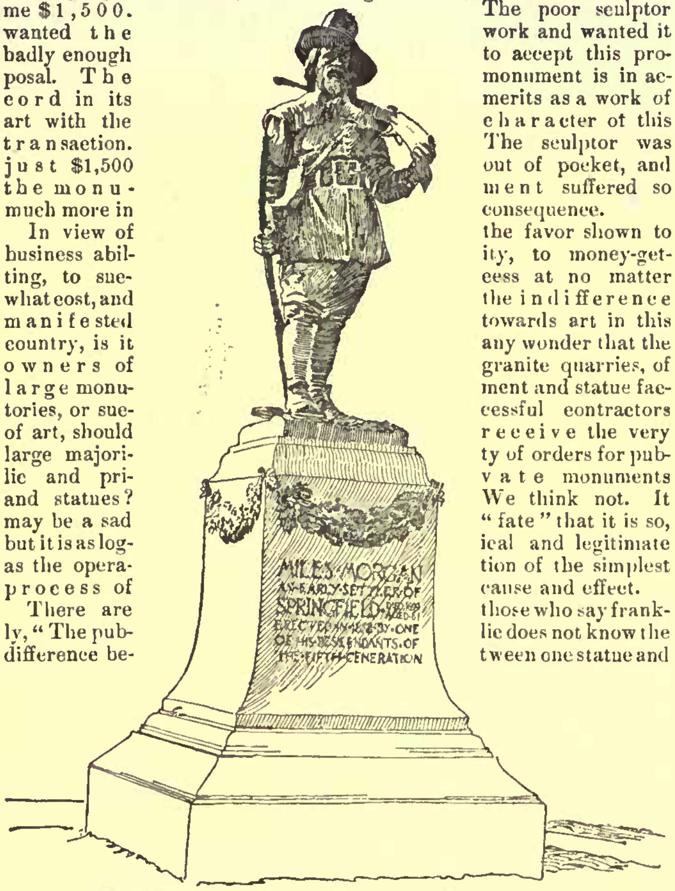
bind the sculptor to perform more than he possibly can accomplisd for the money he is to receive, or, as in some cases, he is obliged to divide his profits with some person who had influence with the committee. Here is the last occurrence of this kind that has come to our knowledge. In a certain city in a neighboring State a $30,000 soldiers' monument was in process of competition. A

[1] Continued from page 109, No. 558.

citizen of the place came to an untrained and uncultivated sculptor who wanted the job, and said, "I have subscribed $2,500 towards this monument; now, I have sufficient influence with the committee to get you the work, and I will get it for you if you will allow me $1,500. The poor sculptor wanted the work and wanted it badly enough to accept this proposal. The monument is in accord in its merits as a work of art with the character of this transaction. The sculptor was just $1,500 out of pocket, and the monument suffered so much more in consequence.

In view of the favor shown to business ability, to money-getting, to success at no matter what cost, and the indifference manifested towards art in this country, is it any wonder that the owners of granite quarries, of large monument and statue factories, or successful contractors of art, should receive the very large majority of orders for public and private monuments and statues? We think not. It may be a sad "fate" that it is so, but it is as logical and legitimate as the operation of the simplest process of cause and effect.

There are those who say frankly, "The public does not know the difference between one statue and another.



Miles Morgan, Springfield, Mass. J. S. Hartley, Sculptor.

It is as likely to condemn as to admire a good one. Mr. Ward's statues are more carefully executed than those of A or B, but why should we pay $20,000 for a statue that is only a little better made than one we can get for $5,000? This does not indicate, perhaps, a very great regard for sculpture, but it does show that for workmanship alone there is not a universal disposition to pay an extravagant price.

THE ROGER WILLIAMS MONUMENT.

The Roger Williams monument was unveiled in Roger Williams Park, Providence, R. I., October 16, 1877. It was made by Franklin Simmons, of Rome, Italy, and is composed of a pedestal and two statues, one of Williams, and the other called "History;" the height of the former being seven feet six inches, and the latter six feet six inches. The book that Williams holds in his left band is inscribed "Soul Liberty, 1636."

The strange claim is made for this monument that "This is probably the only monument in which the experiment has been tried of erecting two figures, one above the other, in the same composition, and the success is complete."

Whatever criticism may be made on this structure, in at least one important respect, the statue of Williams is better than "the Pilgrim." Mr. Simmons has tried to show what Roger Williams did. If the statue is neither strong nor imposing, it certainly is not coarse or pretentious.

MILES MORGAN.

The bronze statue, named Miles Morgan, was erected in Springfield, Mass., October 24, 1882. The subject of this statue was one of the early "planters" of that town, arriving there in 1636.

The statue with its pedestal was presented to the city of Springfield by Henry T. Morgan, of New York, a descendant of Miles Morgan in the fifth generation. The monument was erected without ceremony, the giver wishing no ostentation in connection with it. The figure is dressed in Puritan costume; carrying an old blunderbuss on its left shoulder, while the right hand holds a long-handled hoe. It is probably the funniest object set up as a statue in the United States, not excepting those used on soldiers' monuments.

He does not seem to feel the weight of the severities and solemnities of Puritan life, for that jaunty hat suggests more of the jollity of Merry Mount than of Plymouth asceticism. The statue was made by Mr. J. S. Hartley, of New York.

The Springfield papers speak ardently of the certain influence for good this statue is destined to have upon the progress of art in that city. They affirm that its excellence as a work of art will effectually prevent the advent of any bad statues, and set a high-water mark for greater progress in the future. "The Morgan" has one advantage over "the Pilgrim," in the lasting curiosity it excites. A curiosity that more than makes up for the absence of any quality of sculpture.

It is an enjoyable relief to see Miles Morgan, careless and indifferent, after beholding the awful Cromwellian responsibility of "the Pilgrim," and the monumental and nerveless sanctity of "the Roger Williams."

JOHN BRIDGE.

A bronze statue nine feet high, called "John Bridge, the Puritan," was unveiled on Cambridge Common, Mass., November 28th, 1882. The commission to execute it was given to the late T. R. Gould, of Boston. He died soon after beginning the work, and his son, M. S. Gould completed it. The whole monument was presented to the city of Cambridge by S. R. Bridge, a descendant in the sixth generation of John Bridge. John Bridge came to Cambridge in 1636, was one of the founders, and a very useful and honorable citizen of the town.

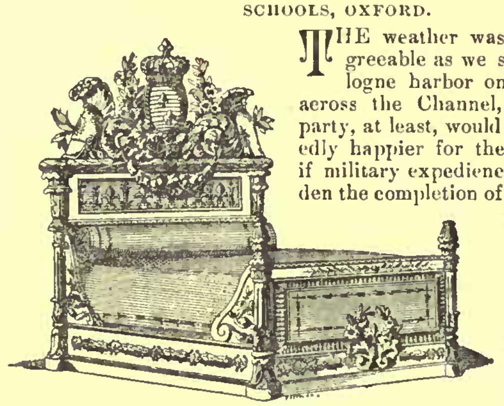
Those immediately interested in this statue claim that it represents with absolute correctness the costume of an "original Puritan," and that it is "an undoubted impersonation of the typical Puritan, in whose stern and resolute countenance is fully reflected the strong character of the men who founded our New England institutions of freedom and education." No comment has been made by the press upon this statue as a work of art.

The statues of Bridge and Morgan are confirmations of the existence in this country of two splendid facts, love for ancestors, and generosity in desiring to honor their memories. But the disparity between these statues as works of art, and the noble sentiments that inspired those who erected them is so great, that one is obliged to think it would have been better to have trusted to the ordinary processes of memory, rather than to have undertaken to perpetuate their remembrance in any such fashion. T. H. Bartlett.

[To be continued.]

AN EDITOR'S TRIP ABROAD.[1] — XV.

LONDON SUBURBAN HOUSES. — SALISBURY. — THE EXAMINATION SCHOOLS, OXFORD.



The weather was rainy and disagreeable as we sailed out of Boulogne harbor on our return trip across the Channel, and one of the party, at least, would have been decidedly happier for the next two hours if military expediency had not forbidden the completion of the tunnel which, two or three years ago, was on the point of making a land connection between France and England. Whether anything short of submarine railway communication will do away with the dreaded Channel sea-sickness seems to be doubtful. If I am not mistaken, the twin ship which was to float steadily across is now abandoned, and the efforts of the lines which compete with each other for the profitable international traffic seem to be directed entirely to the construction of very fast vessels, the one last put in commission having crossed from Dover to Calais in about seventy minutes, making at times a speed of twenty-five miles an hour. Although these little racers reduce the duration of the sea trip, and of the worst of the accompanying discomfort, their motion is so disagreeable that the sea-sickness provoked by it sometimes lasts through the railway journey which succeeds it, and passes off only when the train comes to a stop in London. Fortunately none of us were quite sensitive enough for that, and before arriving within sight of the dome of St. Paul's we were quite ready to enjoy the first sniff of that friendly smell of soft-coal smoke which welcomes the traveller to London; and, as we stepped out upon the platform, to find ourselves hailed in good old English by a dozen railway-porters and cab-drivers, it seemed to us as if a load, which had been weighing upon us for three months, was suddenly lifted off our minds. A little of it was perhaps replaced when the cab-driver, on arriving at the hotel, found himself dissatisfied with something more than his proper fare, but an extra sixpence made us perfect friends again, and he was, at least, neither so greedy nor so disagreeable as one of his brethren in Brussels, from whom we finally declined altogether to purchase peace, and left him to listen to the echoes of his maledictions which the pavement sent back to him.

The region about Piccadilly Circus, and from that westward to Hyde Park and South Kensington, and eastward to London Bridge, was already pretty familiar to us, so that we thought it desirable, for the better improvement of our minds, to take some pains to explore the more remote portions of the city, and found ourselves well repaid for our trouble. Interesting as are the great buildings in the interior of London, they do not, by any means, monopolize the architectural beauties of the town, and no one can fully appreciate the vast, homelike, English London without devoting a part of his time

[1] Continued from No. 561, page 145.

to Hampstead and Chelsea, Newington, Chiswick, and a dozen other suburban districts, which, not long ago, were quiet villages, but are now fast filling up with detached and semi-detached houses, of all grades, but all neat and homelike, and many of them extremely interesting. The best houses are, perhaps, to be found to the south and southwest of the city, where an immense space, extending now to the grounds of the Crystal Palace at Sydenham, has, within a few years, been occupied by new buildings, most of which are of a superior class, while many, with their beautiful grounds, must represent investments of money varying from fifty to a hundred and fifty thousand dollars, or even more. These suburban mansions, while far from possessing the dignity of a great country house, buried in the middle of its acres of park, have in place of it an air of domestic elegance and comfort which is quite as interesting in its way. I tried my best to discover, by analyzing and comparing the houses that most took my fancy, the secret of the homelike flavor which the English architects succeed so well in imparting to their designs, but made very little progress, my conclusions being constantly upset by the result of fresh observations. In Brompton, for instance, I would become enamored of a lovely house with half-timbered gables, and would make a mental memorandum of the fact that half-timber and plaster were necessary ingredients of the most perfect expression of English domesticity, which would, in half an hour or so, be supplanted by another memorandum, derived from the study of a house still more charming than the other, to the effect that, when well treated, a composition of white brick, slightly relieved with red, was more satisfying in its picturesqueness than any timber construction. A little later I would qualify the last impression with the codicil that, for a house surrounded by the luxuriant vegetation universal in English gardens, neither white brick by itself nor any combination of this with red brick, could compare in warmth and richness with red brick used alone; and soon after I would find myself again convinced of the superiority of half-timber work to any other. On a calmer review of the whole subject I am disposed to think that no material, either for domestic or any other sort of architectural expression, can equal stone, but the best of the English architects treat the other ordinary materials in a way which cannot be too carefully studied. Next to the Southern suburbs the Northern districts of London are, perhaps, the richest in architectural pleasures, and, as these are rather more closely built than the former, interesting objects occur more frequently. Perhaps the best things here are the churches, among which there are many of remarkable originality, but one continually comes across other clever bits of work, modest in construction and material, but full of thought and artistic feeling.

From the new to the old in England is never a very long step, and we observe some change in style and finish, but very little in the delightfully homelike expression of the buildings, between suburban London, the creation of the last two decades, and Salisbury, the central portion of which contains few houses less than a hundred and fifty years old, while many, of three and four hundred years standing, vie in neatness and comfort with the most recent of their neighbors.

In regard to design, after carefully endeavoring to separate the essential and intentional qualities of the older houses from the effects of time and accident, it seemed to me that although, like our own builders of a hundred and fifty years ago, the men who constructed the old houses which stand around the Cathedral Close were probably thoroughly drilled in a set of rules which prevented them from ever making such gross blunders in the proportioning of openings, or in the profiling of mouldings, as those which disfigure cheap or careless modern work, there was very little about their buildings that could be considered actually superior to those of the best architects of the present day, and I could see no way of accounting for the unspeakable charm of the old houses except by attributing it in part to the softening of the colors and lines by the action of the atmosphere, and the settlement of walls, and the bending of the rafters, which soon throws the rigid parallel lines of the roof tiling into delicate curves, but still more to the faint yet significant indications of alteration or repair which nearly all show, and which unconsciously excite our interest and sympathy, as do the lines which give character to a face by suggesting the mental and moral experiences through which its owner has passed.

This sort of adventitious charm, the shining of the Lamp of Memory, as Mr. Ruskin would say, probably counts for more in the pleasure which we take in observing old buildings than we generally imagine.

The wall which surrounds the Cathedral Close in Salisbury, a work apparently of the thirteenth century, perhaps modified somewhat later, is still almost intact, and forms one of the most interesting features of the town. In itself the wall is simple enough, consisting of limestone masonry, in some places crowned with battlements, but in others only tiled over to keep the rain out of the joints, and it would, to any one who knew nothing of its history, present no more attraction than any other fence wall, were it not for the circumstance that the masons who built it, six hundred years ago, to save themselves the trouble of cutting all the blocks out of new stone, utilized the materials of a Norman building, which they either found near by, or, more probably, brought over from the hill of Old Sarum, on which the original metropolitan church stood; and the blocks from the Norman church, carved with the elaborate fancifulness in which the monkish stone-cutters of the time of the Conquest delighted, still diversify the face of the wall with rosettes, bits of string-courses and cornices, and even grotesque heads, which once probably supported the crowning corbel-table. Rude and worn as these fragments are, they attract the eye and excite the imagination at once, and a single one would make an interesting object of a wall a hundred feet long and perfectly plain otherwise. Very little is thus needed to suggest some sort of story, and there are few old houses, particularly in England, where on account of the similarity of our ways of living we find it easier than elsewhere to read slight indications, which do not possess some attraction of the kind.

In modern buildings, which have no history, it is not easy to contrive much expression of sentiment, as we all know. The most successful example, as it seemed to me, that I saw in England of a recent structure, standing in the midst of ancient ones, was certainly Mr. Jackson's Examination Schools at Oxford. So far as the style of the building was concerned, it would be hard to set an architect a more difficult task than to harmonize his design with the conglomeration of Gothic of nearly all periods, side by side with Transition and Renaissance, which characterizes Oxford, but the problem has been solved with astonishing success, and there is no building in the city more thoroughly penetrated with the Oxford air, and yet more free from any appearance of a mixture of different styles. Most architects know well enough the appearance of the structure, from the drawings which have been published in the professional journals, but the drawings give little idea of the dignified aspect of the executed work, or its delightful harmony with the late Gothic and early Renaissance buildings which surround it. Inside, the beautifully-studied Transition style which marks the exterior is, as indeed it was in the ancient buildings from which Mr. Jackson derived his inspiration, a little more markedly classic in detail, and the magnificent stone and marble staircase and balcony which lead to the upper rooms would do no discredit to the richest of Italian palaces, while the woodwork, which is not very different in character from that of our own day, is ornamented with a delicacy and elegance remarkable even in the work of an English architect. There is more of Mr. Jackson's work in Oxford, where, by the way, the architect took his degree, but nothing else so important as the Schools. Next to these, the new buildings for Magdalen College, by Messrs. Bodley and Garner, pleased me most. Being in close connection with a group of late Gothic buildings, the new block was almost necessarily in the same style, but the architects had treated it with a particularly pretty composition of parts, and had made their sculptured detail quite equal in variety and execution to the old work next to it. I was curious to see how the much heralded buildings of fifteen or twenty years ago would compare with the more recent ones, and lost no time in making my way to Keble College and the Oxford Museum, only to find the impression that they made upon me when I saw them before confirmed. In fact, at that time, fresh from the reading of Mr. Ruskin's works, I endeavored conscientiously to find some beauty in them, and succeeded, at least, in impressing on my mind a sort of provisional toleration of them, but a second inspection discovered little in the way of new attractions.

THE ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

"THE DAKOTA," NEW YORK, N. Y. MR. H. J. HARDENBERGH, ARCHITECT, NEW YORK, N. Y.

[Gelatine Print, issued only with the Imperial Edition.]

COMPETITIVE DESIGN FOR A $5,000-HOUSE, SUBMITTED BY "*Wynwyc.*"

EXCAVATIONS: Excavate for cellar under square portion of house; for trench-walls, piers, etc. Dispose of the earth in grading about the building, as may be directed.

Foundations. — Foundation walls to under side of sills to be of good rubble stonework, 1′ 6″ thick, and carried up to a proper height, to secure a cellar 6′ in the clear between under side of first-story floor-joists and top of concrete; all trench-walls 3′ 6″ deep in the ground.

Brickwork. — All brickwork to be of good hard-burnt, to be well laid, with all joints filled solid, all chimneys to be plastered on the inside and outside from cellar to under side of roof. All brickwork exposed on the outside of building to be laid with red mortar joints. Build all fireplaces with pressed brick; hearths of same. Build-in thimbles for ventilators and pipes in all rooms through which the chimneys pass.

Plastering. — Plaster all walls and ceilings in first and second stories one good coat of brown mortar, well smoothed on sides; give all ceilings a coat of white hard-finish. Plaster the ceiling of piazza with cement-mortar and dash with coarse gravel.

Framing. — Sills, 6′ 6″; studs, 2″ x 4″, and 3″ x 4″ for window and door openings. Corner posts and plates, 4″ x 6″; partition caps, 2″ x 4″; floor-beams, first and second floors, 2″ x 10″; all 16″ on centre

rafters, and collar-beams 2″ x 8″, set 28″ on centres; floor-beams cross-bridged once in 8′ 0″ of span. Cover outside of frame sides and roof with surfaced hemlock boards, square edge. Window-frames, except casement, to have pulleys, steel axle, best hemp cords, and weights to balance sash; casements to open out. Door-frames, 1½″-stuff, rebated, 1⅜″ for outside doors, and 1½″ for inside doors. Sash, 1½″ thick, as shown, glazed with double-thick German glass for large lights, single-thick for small lights. All doors to have good, substantial hardware.

Floors. — Lay under-floors in both stories with surfaced hemlock boards; finished floor first story, yellow pine, 3½″ wide; finished floor second story, ⅞″ spruce boards, 5″ wide. Inside trim 5½″ wide, moulded. Base-boards in first and second stories, 7″ wide.

Shingles. — Cover the sides and roofs with sawn cedar shingles, 5½″ to weather. Prepare and put in place 4″ x 6″ gutters. Mouldings, gable cornice, etc., all of white pine.

Bath-room to be finished in brown ash; wainscot 4′ 0″ high, beaded strips 3″ wide, with neat cap. Front stairs to be of ash, as per drawings. Back stairs boxed, and to be of yellow pine from cellar to second floor. Fit butler's pantry with sink closet, with cupboard below and glazed sliding-sash above, enclosing shelves. Kitchen pantry fitted up with shelves. Closets in chambers to have one shelf and twelve hanging-hooks; linen-closet fitted up with wide shelves.

Plumbing. — Furnish and set up range in kitchen, with water-back connected, with forty-gallon copper boiler. French bath-tub in bath-room, supplied with hot and cold water, and fitted with waste-pipe and plug, set up complete. Two Vendome water-closets — one in bath-room and one in cellar — connected with soil-pipe, which, in turn, is connected with sewer, with ventilation up to the highest point of roof. Set force-pump in kitchen, double-acting. All the interior finish to be of white pine, or whitewood, painted two coats of paint; all the exterior trimming will be painted two coats of paint. The shingles and piazza floors will be left the natural color. Wax the yellow-pine floors, first story, two coats.

Concrete cellar-bottom, 2½″ thick. Build cesspool and connect drain.

MASON'S ESTIMATE.

99	Cords stone, laid in wall, @ $3,	$297 00	
151	Yards dirt, @ 20c,	30 20	
8200	Brick, laid, @ $17,	139 40	
4	Fireplaces, @ $12 each,	48 00	
131	Yards concrete, @ 47c per yard,	61 57	
	Cesspool and drain,	41 00	
850	Yards one-coat plastering on wall, @ 20c,	170 00	
438	Yards two-coat plastering ceiling, @ 25c,	109 50	
	Sundries,	27 00	
			$923 67

CARPENTER'S ESTIMATE.

13600	Feet spruce timber, framed and put up, $25,	$330 00	
970	" hard-pine floor, put down, @ 8c,	77 60	
1693	" " " " first story, put down, @ 10c,	160 30	
2840	" spruce " second story, " " 6c,	170 40	
10650	" surfaced hemlock covering, put on, " $17,	181 05	
48000	Shingles on roof, put on, @ $6,	288 00	
18000	" " sides, " " $5,	90 00	
970	Feet white pine for trimming on exterior, put up, @ 6c,	58 20	
5	Dormer windows, put up complete, @ $16,	80 00	
6	Windows and sash, second story, put in complete, @ $5,	30 00	
18	" " first " " " " $6,	108 00	
1	Casement window, complete,	8 00	
2	Dutch doors and frames, put in complete, @ $15,	30 00	
14	Columns on piazza, put up complete, @ $3.25,	45 50	
1	Back door frame, put in " " $3.90,	3 90	
7	Doors and trim., first st'y, principal rooms, complete, @ $7,	49 00	
28	" " remainder of house, @ $5.50,	164 00	
800	Feet shelving, put up complete, @ $0.35 per foot,	28 00	
	Front and back stairs, put up complete,	187 00	
	Butler's pantry, finished complete, lumber, hardware, labor,	47 00	
	Kitchen " " " " "	12 80	
2180	Feet base boards, 6″ high, put down, @ 4c,	87 20	
7	Kegs nails, @ $3,	21 00	
1	Chamber mantel,	13 00	
3	Mantels first story, @ $30,	90 00	
	Material and labor finishing bath-room, complete,	45 00	
	" " " water-closet in cellar, complete,	4 50	
	Seat in hall and library, material and labor,	10 60	
	6 bells, put in complete, @ $4,	24 00	
	Furnace piping and registers, put in complete,	171 00	
	Plumbers' work, complete,	276 00	
	Painters' work, interior and exterior,	215 00	
	Stained-glass hall-windows,	46 00	
	Range in kitchen, complete,	58 00	
	Grading around building,	85 00	
	Items and labor not included in the above,	475 00	$3778 85
	Builder's profit, 6 per cent on $4702.52,		284 15
			$4986 67

TOBACCO WORKS OF MESSRS. G. W. GAIL & AX, BALTIMORE, MD. MR. HENRY BRAUNS, ARCHITECT, CHICAGO, ILL.

This building has a frontage on Barre Street of 278 feet, and on S. Charles Street of 183 feet — with two interior court-yards of about 50′ x 100′ each — and has been enlarged from time to time, the first building having been erected about thirty years ago. The addition now being built is 134′ x 183′, and is to be used mostly for storage purposes, with a capacity for 5,000 hhds. of tobacco. Interior construction is with iron columns and girders. The exterior is faced with Baltimore pressed brick and granite cornices, etc. Cost of addition about $150,000.

ENDOLITHIC-MARBLE MANTEL FOR THE PLANKINGTON HOUSE, MILWAUKEE, WIS. DESIGN BY MR. CARYL COLEMAN, NEW YORK, N. Y.

This mantel, Persian in color and design, is wholly made of highly-polished Endolithic marbles, except the inner arch, which is constructed of red glazed brick. The prevailing colors are: a rich yellow Siena, a delicate reddish-yellow Numidian, and a deep blue Brecciated marble.

The decorations have all the sharpness of outline of a Florentine mosaic with great depth and transparency of color. The mantel is in a room where the floor and dado are also in decorated marble, while the walls and ceiling are painted to harmonize in color and design — everything being strictly and purely Persian.

HOUSE OF MR. H. M. DUNHAM, SOMERVILLE, MASS. MR. G. F. LORING, ARCHITECT, BOSTON, MASS.

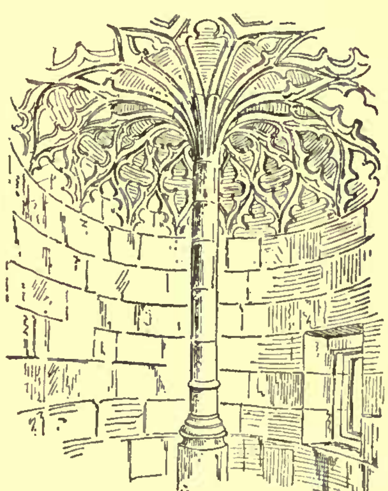
HOUSE FOR H. F. CADY, ESQ., NEBRASKA CITY, NEB. MESSRS. MENDELSSOHN & FISHER, ARCHITECTS, OMAHA, NEB.

COMPETITIVE DESIGN FOR A $5,000 HOUSE, SUBMITTED BY "*Demavend.*"

BROOKLYN LIFE INSURANCE COMPANY'S BUILDING, LIBERTY STREET, NEW YORK, N. Y. MR. F. CARLES MERRY, ARCHITECT, NEW YORK, N. Y.

Unintentionally, the title of this plate was published in our last issue, and gave the impression to many that they received an imperfect copy, because the plate was not included in the illustrations.

AMERICAN ARCHITECT COMPETITION FOR HOUSE COSTING $5,000.[1]—VIII.



STAIR CASE CEILING. KYME TOWER.
AA SKETCH BOOK, LONDON. LINCOLNSHIRE, ENG.

"*Wynwyc.*"—Plan is not good. Study not well placed; second story plan is poorly arranged; corridor narrow and dark; closets cut off much light in rooms. General lay-out of exterior very good, and details, though unskilful, are of a very good kind. With a different arrangement of plan this would make an excellent house. Rendering timid and uncertain.

"*Demavend.*" — Evidently a beginner's work. Plan requires extra servant; otherwise, ordinarily good. Details meagre. Exterior needs belts, eaves, mouldings, rakes. Roofed badly; termination of circular bay very bad. Rendering timid and unskilful; lettering poor.

"*Ivy.*" — Basement kitchen requires extra servant. Hall too large for house. Interior: mouldings and staircase good; study fireplace all out of scale with room and not a clever conceit. Exterior details: mouldings lack proportion and small transitional members. Design commonplace. A truncated gable is always ugly, but when in combination with flap-dormers and a French-roofed piazza it is especially bad.

"*Veritas.*" — Novelist isolated. Waste space in hall and roof. Exterior details have too many sharp angles, giving very boxy look. Piazza roof joins house badly. Interior detail fairly good; proportions of first and second story walls to each other and to roof not good. Lettering very bad. Rendering weak.

"*Idle Hours.*" — Plan fairly good. Infants' room inconvenient. Separation of bedrooms, etc., from remainder of house good. Direct communication between dining-room and kitchen is not good. No constructive details. Exterior overdone, with details of all sorts without any regard to scale or purpose: stone, brick, plaster, open-timber work, shingles, zig-zag brickwork and skewbacks, diamond-square and roomed window-panes, and Classic garlands make a mixture that cannot fail to be conspicuous, but that belongs to just that class of buildings which are spiced to suit the imaginary public taste, and are more vicious than simple, ugly work. Rendering lacks concentration, and is labored, but rather effective.

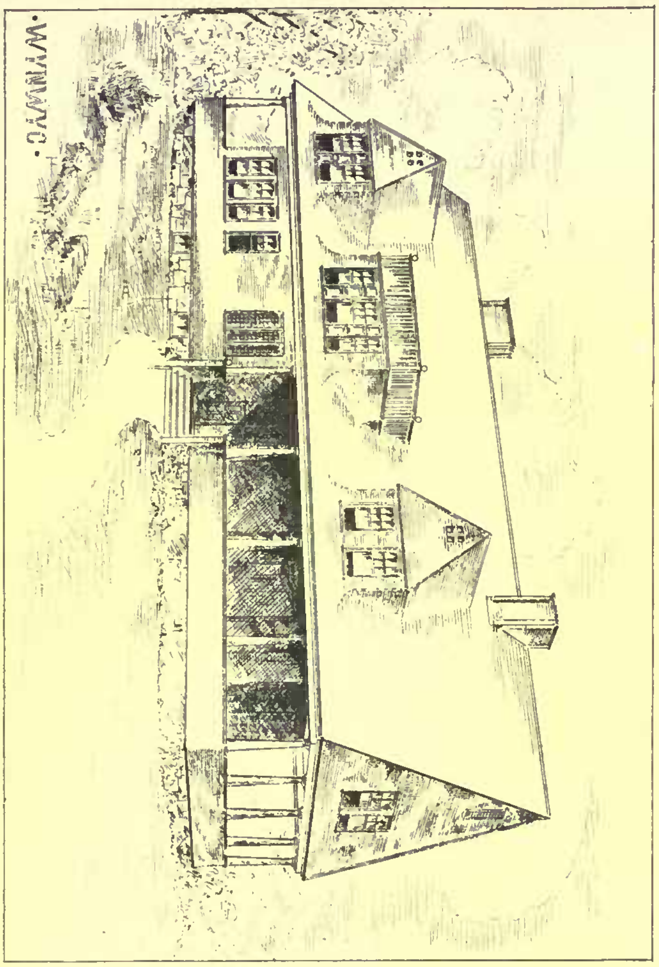
"*Wamba.*" — Waste room in halls; bedrooms badly shaped; nursery too small. Interior details heavy. Exterior details made without much constructional knowledge. Exterior too much chopped up. Rendering of plans good. Rendering of perspective stiff in ruled lines; uncertain in freehand lines.

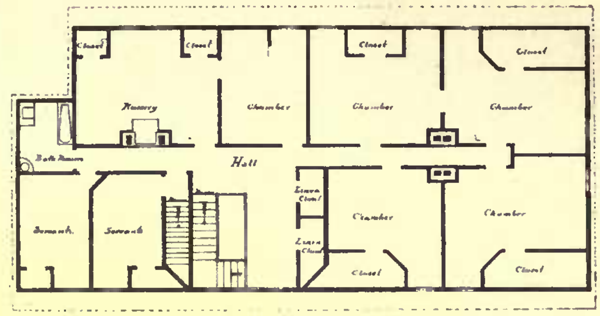
"*India Ink.*" — Back stairs dark. Too many chimneys. Details of interior commonplace and heavy. Exterior design poor; walls too high; window-panes too small; open-timber work not understood. Rendering of elevation and perspective extremely bad — spotty and scratchy.

[To be continued.]

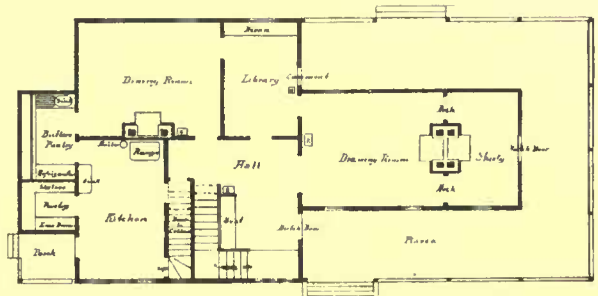
A Dakota Peat-bog. — A hundred-acre peat-bog has been discovered near Ellendale, Dakota. The peat reaches to a depth of from seven to ten feet, and is said to overlay a surface of ice. — *Exchange.*

[1] Continued from page 111, No. 558.



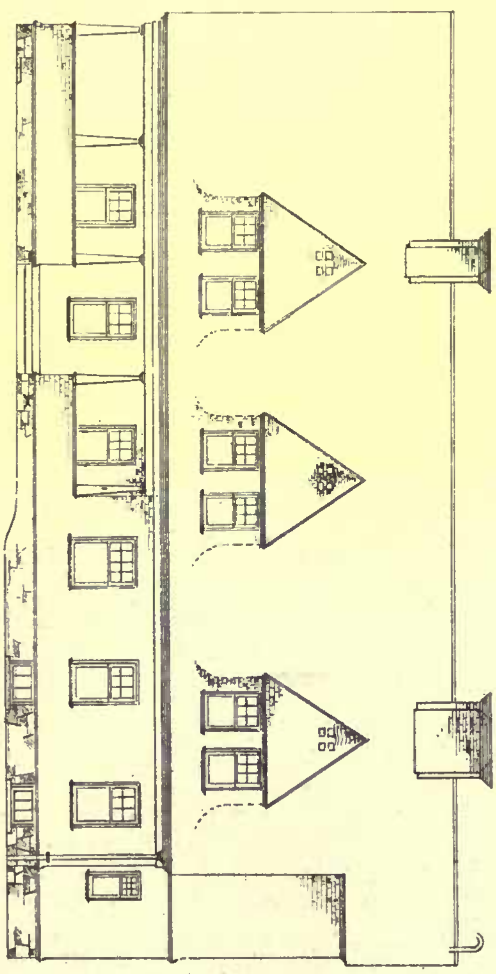


- Second Floor Plan -

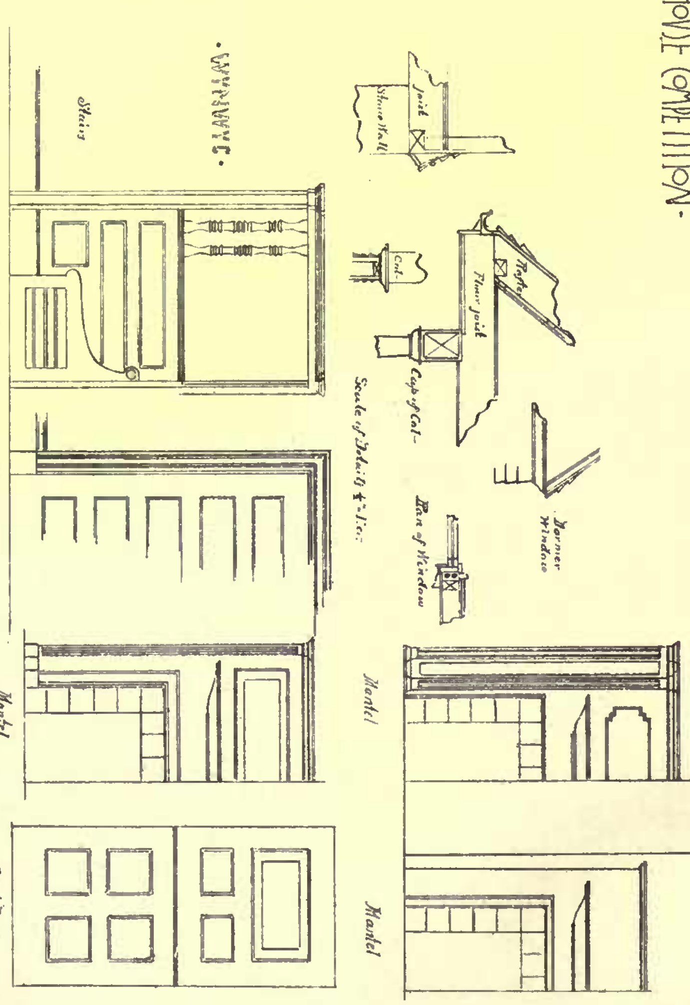


- First Floor Plan -

AM. ARCHT. $5000 HOUSE COMPETITION.



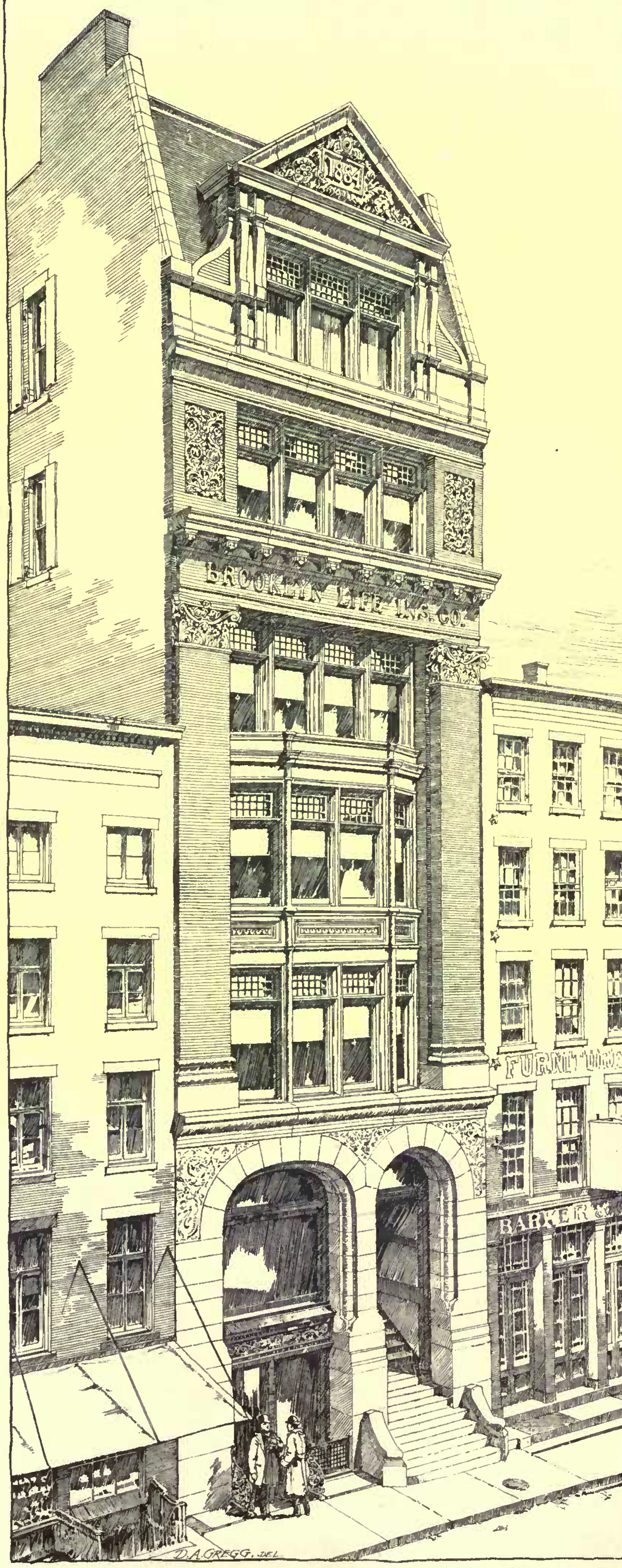
- South Elevation -

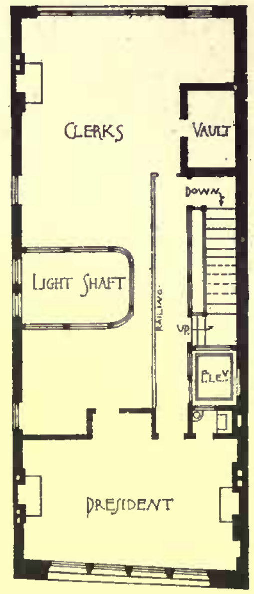


Heliotype Printing Co. Boston.

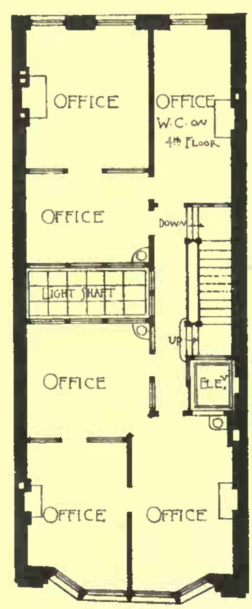
Brooklyn Life Ins: Co's: Building, Liberty St: New York.

F. Carles Merry, Arch't. 150 B'way, N.Y.

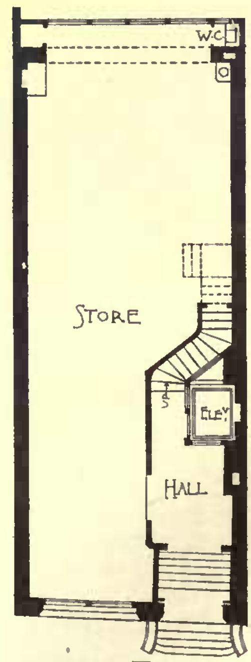




Company's Offices
Fifth Floor

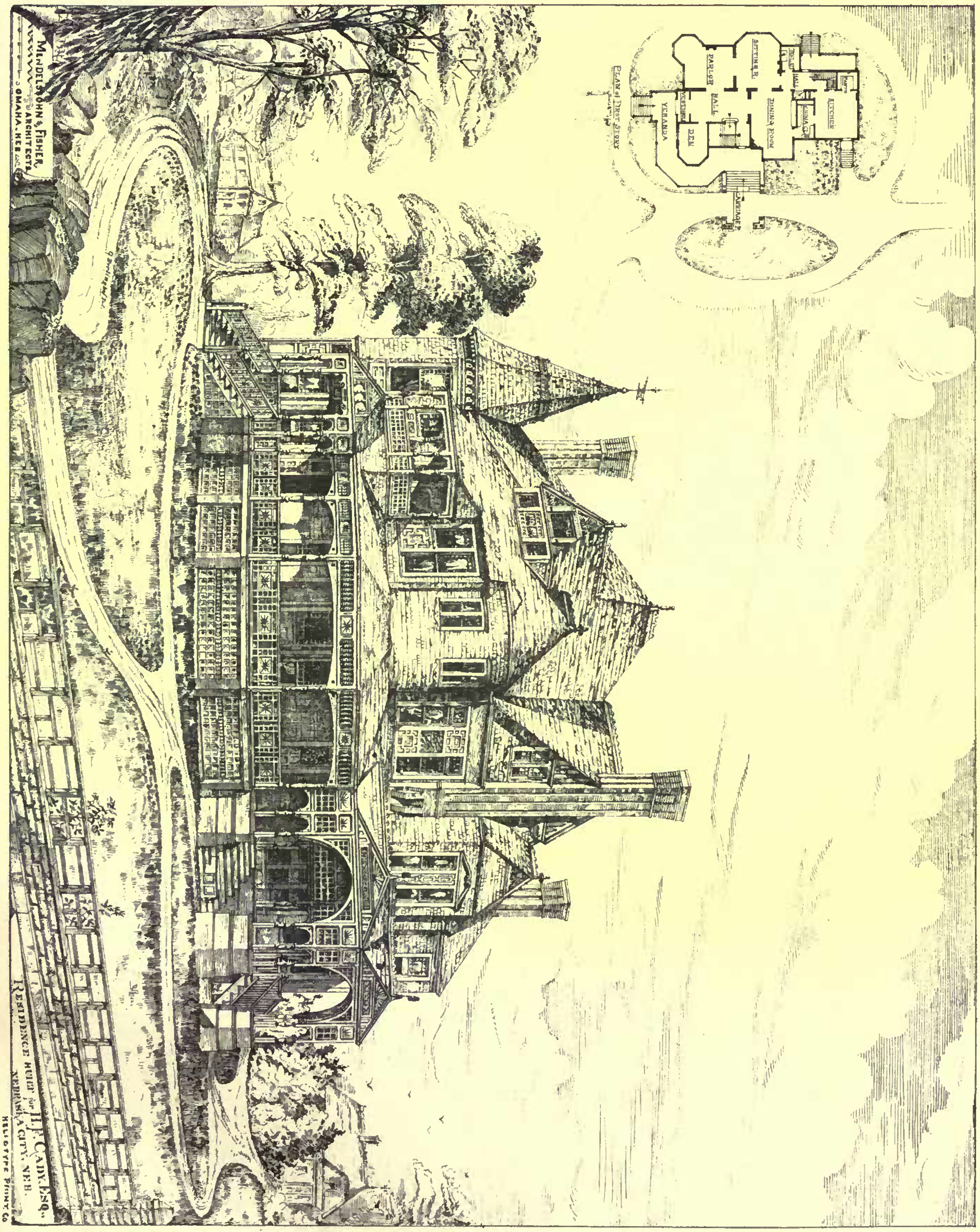


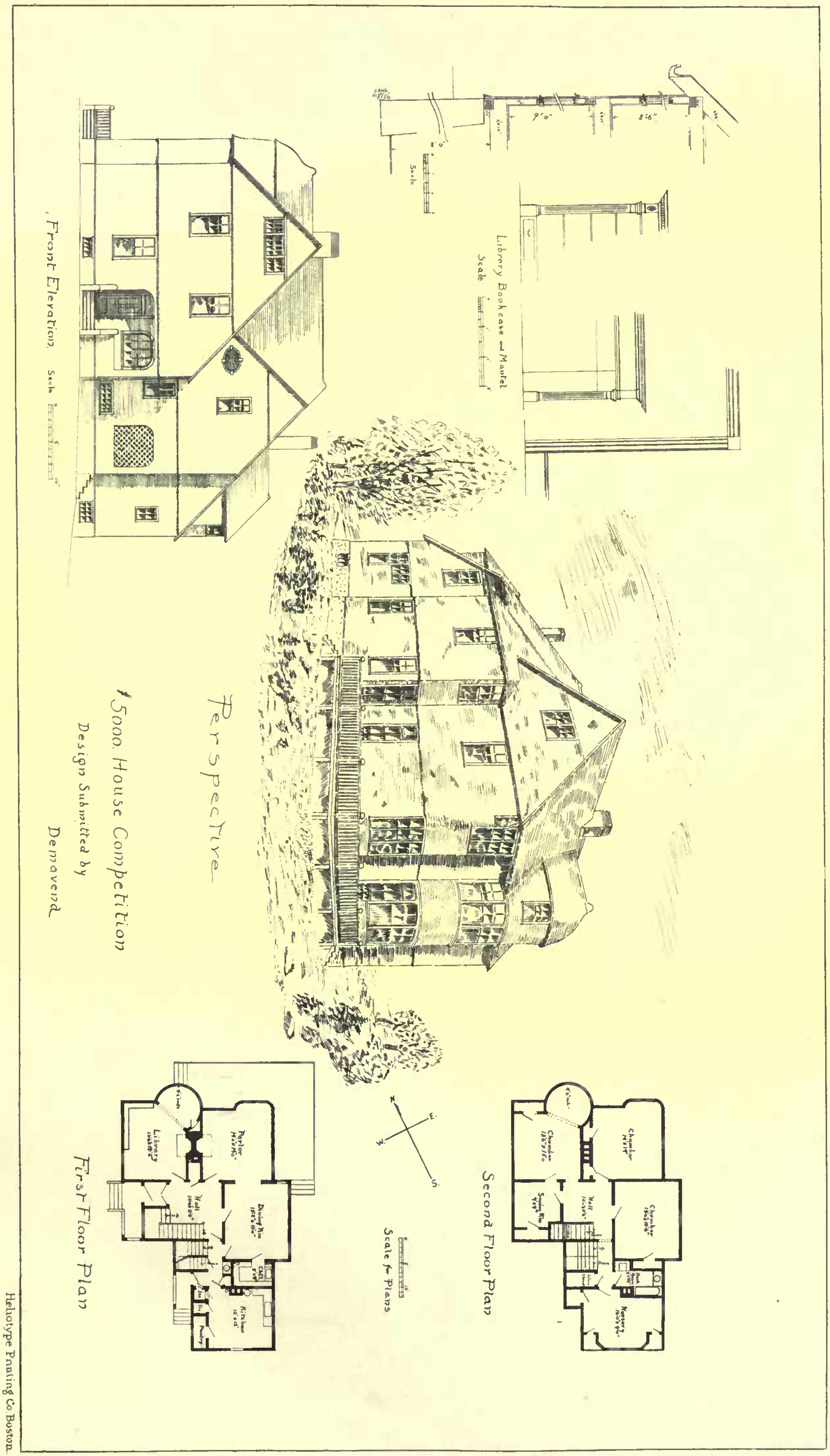
Third Floor
2 & 4 almost the same



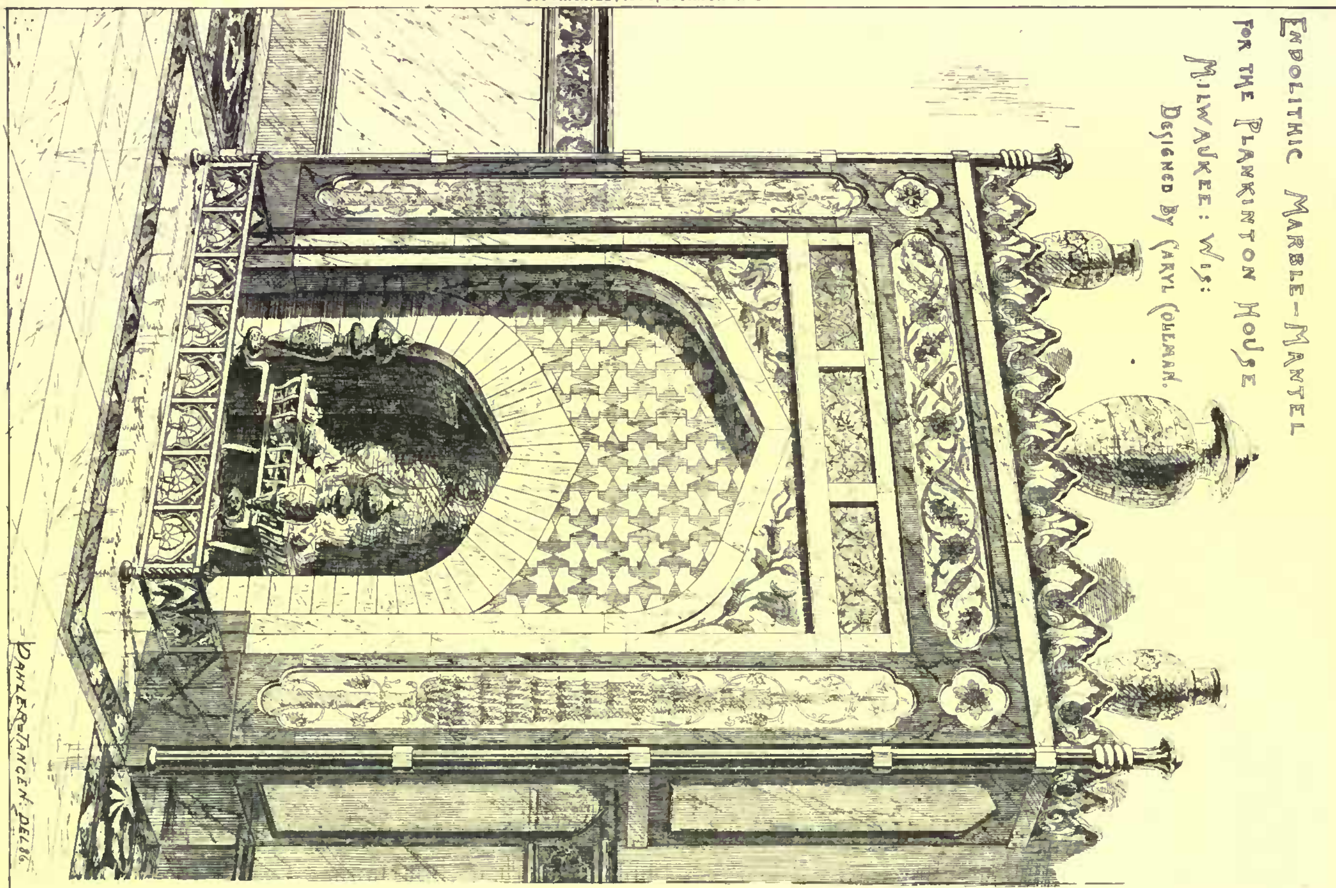
First Floor.

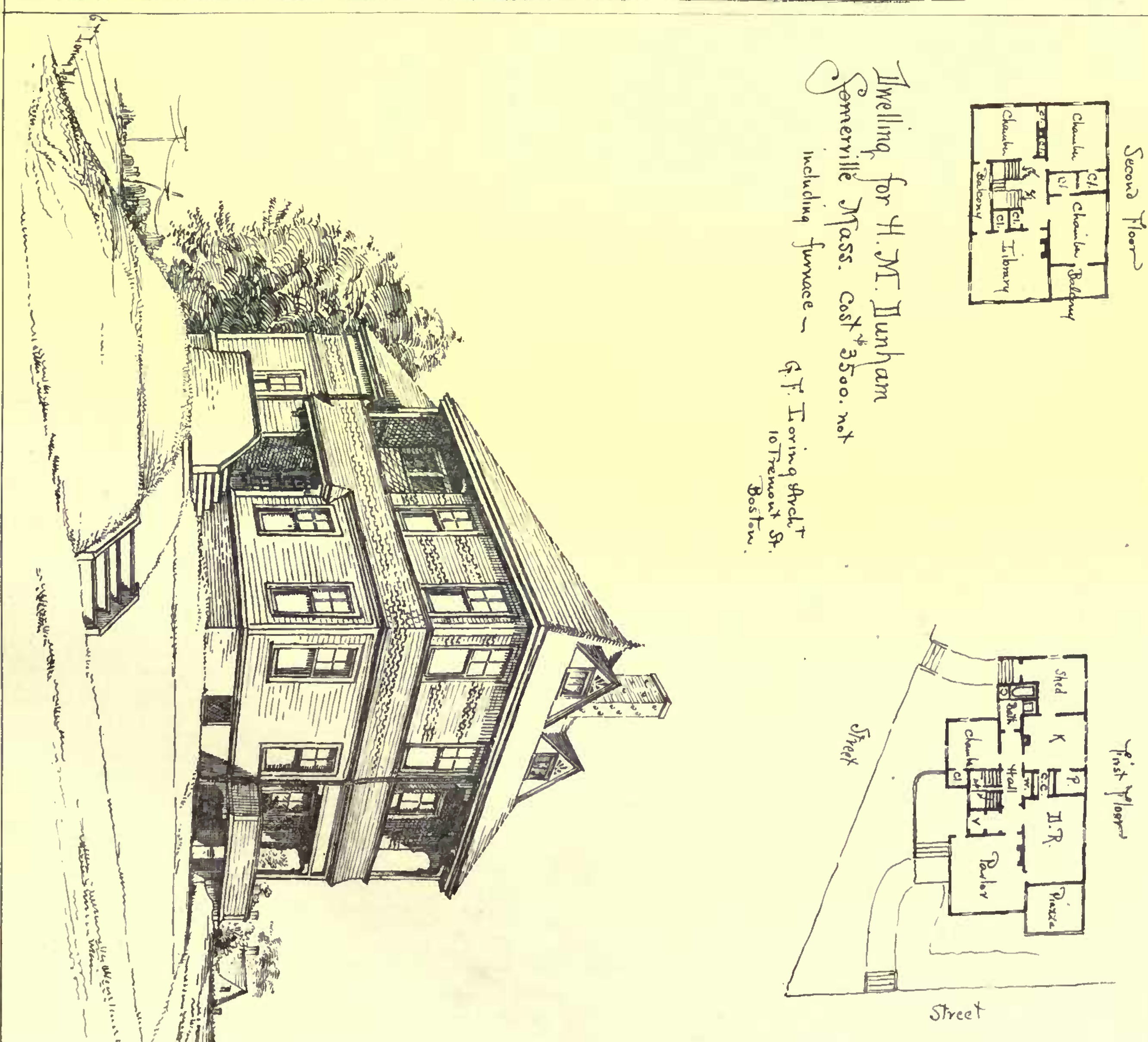



Mendelssohn & Fisher,
Architects,
Omaha, Neb.
Residence built for H. F. Cady, Esq.,
Nebraska City, Neb.
Parlor
Sitting R.
Hall
Dining Room
Kitchen
Den
Veranda
Carriage
Plan of First Story
Heliotype Print. Co.



Heliotype Printing Co. Boston.





HELIOTYPE PRINT. CO.

SAFE BUILDING.[1]—VIII.

DEFLECTION.

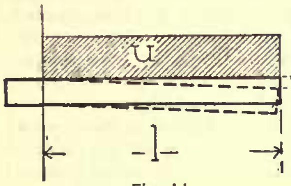


Fig. 11.

THE derivation of the following formulæ would be too lengthy to go into here, it will suffice for all practical purposes to give them. They are all based on the moduli of elasticity of the different materials, and are as follows:

FOR A CANTILEVER, UNIFORMLY LOADED.

$$\delta = \frac{1}{8} \cdot \frac{u.l^3}{e.i} \qquad (36)$$

FOR A CANTILEVER, LOADED AT FREE END.

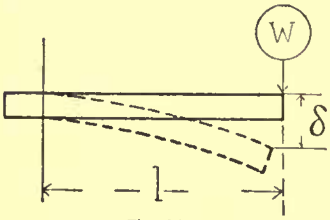


Fig. 12.

$$\delta = \frac{1}{3} \cdot \frac{w.l^3}{e.i} \qquad (37)$$

FOR A BEAM, UNIFORMLY LOADED.

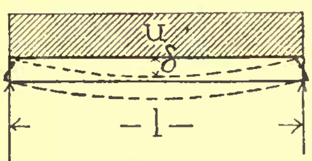


Fig. 13.

$$\delta = \frac{5}{384} \cdot \frac{u.l^3}{e.i} \qquad (38)$$

FOR A BEAM, LOADED AT CENTRE.

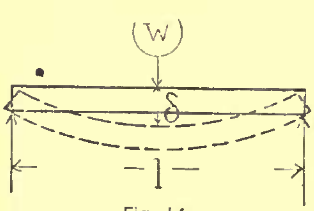


Fig. 14.

$$\delta = \frac{1}{48} \cdot \frac{w.l^3}{e.i} \qquad (39)$$

FOR A BEAM, LOADED AT ANY POINT.

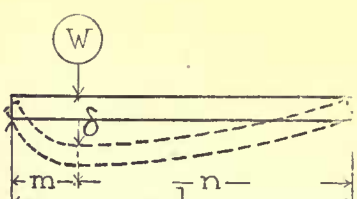


Fig. 15.

Greatest deflection is at the point where load is applied.

$$\delta = \frac{w.m.n.(l+n)}{9.l.e.i} \cdot \sqrt{\frac{m.(l+n)}{3}} \qquad (40)$$

Where u = uniform load, in pounds.
Where w = concentrated load, in pounds.
Where l = length of span, in inches.
Where e = the modulus of elasticity, in pounds-inch, of the material, see Tables IV and V.
Where i = the moment of inertia, of cross-section, in inches.
Where m and n = the respective distances to supports, in inches.
Where δ = the greatest deflection, in inches (see Formulæ 28 and 29).

For a cantilever, with concentrated load, at any point, use Formula (37), inserting distance x (in inches) of load from support, in place of l, or:

$$\delta = \frac{1}{3} \cdot \frac{w.x^3}{e.i} \qquad (41)$$

EXPANSION AND CONTRACTION OF MATERIALS.

Expansion of iron trusses. All long iron trusses, *say about eighty feet long, or over*, should not be built-in solidly at both ends; otherwise the expansion and contraction due to variations of the temperature will either burst one of the supports, or else cause the truss to deflect so much, as to crack, and possibly endanger the work overhead. One end should be left free to move (lengthwise of truss) on rollers, but otherwise braced and anchored, the anchor sliding through slits in truss, as necessary. The expansion of iron for each additional single degree of temperature, Fahrenheit, is about equal to $\frac{1}{145000}$ of its length, that is, a truss 145 feet long at 10° Fahrenheit, would gain in length (if the temperature advanced to 100° Fahrenheit), — $\frac{90.145}{145000} = \frac{9}{100}$ of a foot, or, say, $1\frac{1}{12}$ inches, so that at 100° Fahrenheit the truss would be 145 feet and $1\frac{1}{12}$ inches long; this amount of expansion would necessitate rollers under one end. Of course the contraction would be in the same proportion. The approximate expansion of other materials for each additional degree Fahrenheit would be (in parts of their lengths), as follows:

Expansion and contraction of materials.

Wrought-iron	$\frac{1}{145000}$	Pewter	$\frac{1}{78000}$
Cast-iron	$\frac{1}{162000}$	Platina	$\frac{1}{208000}$
Steel	$\frac{1}{151000}$	Zinc	$\frac{1}{62000}$
Antimony	$\frac{1}{166000}$	Glass	$\frac{1}{210000}$
Gold, annealed	$\frac{1}{123000}$	Granite	$\frac{1}{208000}$
Bismuth	$\frac{1}{130000}$	Fire Brick	$\frac{1}{305000}$
Copper	$\frac{1}{104000}$	Hard Brick	$\frac{1}{600000}$
Brass	$\frac{1}{95000}$	White Marble	$\frac{1}{173000}$
Silver	$\frac{1}{95000}$	Slate	$\frac{1}{173000}$
Gun metal	$\frac{1}{90000}$	Sandstone	$\frac{1}{103000}$
Tin	$\frac{1}{87000}$	White pine	$\frac{1}{440000}$
Lead	$\frac{1}{63000}$	Cement	$\frac{1}{120000}$
Solder	$\frac{1}{70000}$		

The tension due to each additional degree of Fahrenheit would be equal to the modulus of elasticity of any material multiplied by the above fraction; or about 186 pounds per square inch of cross-section, for wrought-iron. Above figures are for linear dimensions, the superficial extension would be equal to twice the linear, while the cubical extension would be equal to three times the linear.

Water is at its maximum density at about 39° Fahrenheit; above that it expands by additional heat, and below that point it expands by less heat. At 32° Fahrenheit water freezes, and in so doing expands nearly $\frac{1}{12}$ part of its bulk, this strain equal to about 30,000 lbs. per square inch will burst iron or other pipes not sufficiently strong to resist such a pressure. The above table of expansions might be useful in many calculations of expansions in buildings; for instance, were we to make the sandstone copings of a building in 10-foot lengths, and assume the variation of temperature from summer sun to winter cold would be about 150° Fahrenheit, each stone would expand $\frac{150.10}{103000} = \frac{1}{68}$ of a foot, or, say, about $\frac{1}{6}$ inches, quite sufficient to open the mortar joint and let the water in. The stones should, therefore, be much shorter.

[1] Continued from No. 558, page 115.

GLOSSARY OF SYMBOLS.—The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.:—
a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
f = *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g_1 = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches. [See Table I.]
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right-hand re-action* (or support) of beams, in pounds.
r = *moment of resistance*, in inches. [See Table I.]
s = *strain*, in pounds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
𝔡 = *diameter*, in inches.
𝔯 = *radius*, in inches.
π = 3.14159, or, say, 3.1-7 signifies the *ratio of the circumference and diameter of a circle*.
If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_I, a_{II}, a_{III}, etc., or b, b_I, b_{II}, b_{III}, etc.
In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance:—
m = moment or bending moment at *centre*.
m_A = " " " *point A*.
m_B = " " " *point B*.
m_X = " " " *point X*.
s = strain at *centre*.
s_B = " *point B*.
s_X = " *point X*.
v = stress at *centre*.
v_D = " *point D*.
v_X = " *point X*.
w = load at *centre*.
w_A = " *point A*.

OLD ART COME TO LIGHT.[1]



VASE DECORATED BY CLODION.
REVUE DES ARTS DECORATIFS

THE fresh light continually being thrown upon classical antiquity through the research of German scholars and archæologists cannot fail to awaken the attention and interest of an intelligent public. Within the past year changes have taken place in the organization of the Imperial Archæological Society of Germany which the experience of the society has shown to be a necessity. But the great ends of research are steadily and practically kept in view. Young men of eminent gifts are still sent out equipped with a generous allowance to bring in the facts so necessary in building up a true science; and in the recent publications it is delightful to meet new names, and to notice, from the excellent work done, the advantages enjoyed by the protégés of the Institute. The material given to us this year is not marked by new and astonishing discoveries, but by so happy an application of sound methods to old problems that hidden truths are at last wrung from them. Taking a new departure, the Institute plans to emphasize more strongly the educational department in its schools in Athens and in Rome, and to adapt its publications more closely to the changed relations of things in the world of discovery. Great as will be the advantages of the new system, yet sadly will be missed the patriarchal figure of Henzen, father of Roman epigraphy, when he retires from his position of First Secretary of the Institute in Rome, a position he has made honorable by a life of self-sacrificing devotion and faithful research. And no less will be the loss in Athens when the eminent Köhler leaves to take the Chair of Ancient History left vacant in the Berlin University by the death of Droyson. For ten long years Köhler has unerringly guided the school of the Archæological Institute at Athens, and he has brought it to its present state of efficiency (a task in no way light), besides having completed the great corpus of Attic Inscriptions, an additional work intrusted to his hands by the Berlin Academy of Sciences. By the side of this man of letters and scholar has stood, and still stands in Athens, the practical architect Dörpfeld, a man endowed with a sharp critical eye and a remarkable independence and originality of thought. The rich fruit offered to education and science by the steady and long-continued activity of a school in Athens under such trained directors shows how wise has been the move toward the organization of a similar institution for America, for under wise management our infant school of Archæology at Athens cannot fail of good results for American classical scholarship.

But let us examine what is offered by the recent publications of the Germans.[2] Not another Pergamon or Olympia here captures attention, but so great a mass of information is brought forward that the reader is fairly bewildered with the many, seemingly, minor items, unless he succeeds in placing each rescued fact in the great mosaic, going to make up our historical picture of the past. And, as he fits these, like polished stones, into the whole, and sees completed harmony of color and form, he becomes aware of the priceless value of even the most unpretentious and apparently insignificant item. But what Dörpfeld has seen and proved about the ancient shrines in the Acropolis, and about the renowned Propylæa, its marble entrance, built by Pericles and Mnesicles, are not minor facts. They are of immense importance in gaining a clearer appreciation of the marvelous architecture of Athens in the day of its glory, and hence in the cultivation of a truer æsthetic taste. Many have been the attempts to explain puzzling irregularities in the ground-plan of the Propylæa, as offered by the ruin. Such divergencies from the harmonious symmetry of Greek architecture are there here that in studying the foundations one begins to believe that an erratic genius, like that in Japanese art, delighting in fantastic irregularities, had, for the moment, taken possession of the old classical architect. But Dörpfeld, by keen observation and combinations from the existing ruins, has shown that just as the great original plan of St. Peter's in Rome was altered and cut down to its present condition, in which much of the harmony Bramante would have given the building has disappeared, so the original design for the Propylæa in Athens was far more harmonious than the one actually carried out. When the new temple, the Parthenon, had been completed in 438 B. C., it was decided to build a worthier approach to the Acropolis, one which, transfiguring the site of the cumbrous old Pelasgicon into a marvel of dignity and beauty, should shine forever like a brilliant diadem on the brow of this "mountain of the gods." And Pericles and Mnesicles planned for this ideal structure such a wealth of marble columns and shady porticos that, could they have been carried out, they would have given the Propylæa double the size, and have heightened still more the effect of the rich groups of temples within and beyond. The central part of the structure, there is every reason to believe, was carried out according to the original plan and still shows us Mnesicles's artistic thought. But both of the wings suffered unpleasant limitations. The two smaller portions facing the west were, no doubt, in part completed. The one on the left, and directly overhanging the western precipices of the Acropolis, seems most nearly to represent the architect's original plan, and had its western wall unbroken, as the ruins show. The opposite, or right-hand part, however, was sadly cut down, but was intended, as architectural details show, to be faced by a graceful colonnade, allowing exit, no doubt, to the shrine of Nike Apteros without. An irregular appearance must have thus been given to the front, most difficult, however, to account for, in view of the symmetry prevailing in the remainder of the structure. It is evident that Mnesicles hoped at some happy day to carry out the whole of his original design, and consequently so laid out the building that at any time additions might be made bringing harmony into his now sadly-contracted plan. Out of these architectural irregularities, Dörpfeld has succeeded in rescuing for us the whole of the master's original thought. Adjoining the existing weighty Doric structure of the centre, with its six columns facing the Parthenon, he concluded that there were to stretch out on either side great colonnades, each one having a front of nine marble pillars. This he infers from the existence, both on the north and south of the rear hall of the Propylæa, of two peculiar architectural projections which have been puzzling to every one who has dealt with them. Dörpfeld, however, from a long practical experience with the ruins of ancient architecture, recognizes in these projections those antæ, or pilasters, which are intended to receive the end of an architrave, and which always presupposes a column or columns beyond. Hence he affirms that it was intended to throw columns out both to the north and south in harmonious rows. The length of these is ingeniously determined by the distance on each side to the old walls of the Acropolis.

But not alone upon these puzzling architectural projections does Dörpfeld found his conclusions. The two walls of the Propylæa, at right angles, and now standing all out of doors and facing the east and north, he has discovered to be surmounted, not by the cornice usual on the exterior of buildings, but by the one used invariably as interior finish! Hence it is evident that the walls, now painful in their nakedness, were not meant to be left as exterior, but intended originally as the interior background to a beautiful portico. It could then only be because of some violent change made in the architect's plan that the walls were left exposed as we now see them. Indeed, there are indications from the site itself of the cause of this violent change. In carrying out his regal plan for an extensive portico Mnesicles must necessarily have trespassed on the south, upon the precincts of the old shrine sacred for ages to Artemis Brauronia, and it is clearly conjectured that the jealous priests of the revered shrine made such a hue and cry against the profane innovation that Pericles (who, it may be remembered, was afterward accused of sacrilege) and his architects were obliged, for a time at least, to relinquish their plan. Hoping later to complete it, they worked, in the meanwhile, upon the north wing. But here, in the midst of their labors the Peloponnesian war broke over unhappy Attica, checking all extensive undertakings, and obliging Pericles to abandon many pet projects for the glorification of the city. We know very well that after the conclusion of the war, lasting like that other of modern times well nigh thirty years, the land was completely exhausted, its income reduced to a mere pittance, and its great statesman, Pericles, in his grave. No wonder, then, that the Propylæa, so glorious in their ruin, are but a shadow of what the great minds which conceived them intended.

The other investigations made by Dörpfeld on the Acropolis lead us back to much older days. Adjoining the Erectheum he has recognized in an unsightly mass, hitherto unexplained, the foundations of the old temple to Athena, built by Pisistratus, and later superseded by the much grander structure, the Parthenon, built near by, by Pericles. Thus, another of the missing links, is brought into the chain of Athenian history, and the growth of the shrines on the Acropolis is traced out for us as never before. Study of existing remains and foundations at Sunium has also shown a later, grander shrine supplanting a humbler, older one of *poros*. Strangely enough the stylobate and steps of the older structure are better preserved than many parts of the marble temple which rose upon it, for through three centuries, block after block of the marble has been carried off by sailors as ship's ballast within the past two hundred years, four whole columns besides much else having thus disappeared. Hence

[1] A letter by Lucy M. Mitchell in the New York *Times*.

[2] Mittheilungen des Deutsches Arch. Inst. in Athen IX u. X Bd. Bulletino dell' Institute di Correspondza Archiologica, 1884. Annali dell' Instituto di Correspondenza Arch. Vol. LVI. Monumenti, Vol. XII.

it is not strange that at last the old *poros* structure is again visible, showing the great inferiority of those older monuments destroyed in the Persian War to their brilliant successors, raised by Pericles and his artist contemporaries to adorn the land, and express thanks to the gods. Unfortunately, eager sailor-hands and wearing tempests have greatly injured the marble friezes which once in an unwonted manner ran around the top of the columns of the pronaos. Enough remains to show, however, that conflicts with centaurs and giants as well as some of Theseus's achievements were here represented, these deeds of gods and heroes being among the most popular dogmas of Attic religion.

Of great value in the history of architecture, but especially with regard to the use of color by the Greeks on their temples is the recognition by Dörpfeld of a choragic monument erected by Nicias in 320 B. C. The blocks composing this monument have long been known, but are sadly scattered. The greater part were discovered early in this century at the west foot of the Acropolis and show excellent work — quite equal, indeed, to that of the Periclean age. It is delightful to see the keen-eyed architect fit these scattered stones one to the other by careful measurements, and finally catch from this recomposition a Doric front with six marble columns and a low pediment, as the façade of the monument Nicias erected in honor of his victory in song, while across its architrave ran the inscription, long well known, recording the details of the happy event. Whether this choragic monument, like the one of Thrasyllos, abutted the live rock of the western steep of the Acropolis, or whether it ended in a wall, the whole having thus the full form of a small temple, we do not know. But it is very evident that the architect of this little monument, when he built its front, had in mind the west façade of the central part of the Propylæa towering above, while the architect of the neighboring Thrasyllos monument had in view the south wing of the same glorious structure. Of greater significance for the history of architecture are the facts rescued from Nicias's marble monument tending to settle the vexed question of the application of polychromy. In the same manner that the details of structures discovered in great numbers in Olympia were colored, so here the marble front of Nicias's monument shows that not only the columns and capitals, but the triglyphs and parts of the pediment were colored.

Another monument showing the fertility of the Greek genius in designing from the same elements different forms is a building reported in detail by Koldemy, as traceable among the ruins of Delphi, but discovered by the French. It consists of a front of eight slender columns standing far apart, and raised three steps from the old pavement of the street. Supporting a wooden architrave and a roof, these columns formed a hall to protect a long pedestal running their whole length. According to the extant inscription, strangely enough carved along the base of the columns in the stylobate, and not as usual in the architrave above, this structure and the votive offerings it sheltered were put up by the Athenians in thanks for victory — and it is believed that on this pedestal once stood in a long row the votive statues or groups sent by Athens here to be admirably protected from the weather by the graceful colonnade.

But not religious architecture alone is dealt with in the publications under consideration. The great aqueduct at Samos, an old Greek bath at Alexandria Troas, powerful fortifications, private houses and shops claim our attention. Among these no monument has excited more notice, either in ancient or modern times, among antiquaries, than the aqueduct at ancient Samos. Herodotus described it with enthusiasm as one of the three greatest works of the Greeks, and modern travellers have stood astonished at the perseverance and skill which with the pick alone pierced through the mountain a tunnel one thousand metres long, and successfully brought together the opposite ends. From Fabricius, one of the younger members of the Institute, we now have a detailed account of the stupendous work. The old site of Samos is poor in water, the only abundant spring being in a valley separated from the ancient city by a mountain ridge, on which its old fortifications may still be seen. It was, according to the ancients, the energetic and powerful tyrant, Polycrates, who, seeing the importance of an unbroken water supply, determined to conduct into his capital the water from the exhaustless fountain-head beyond this mountain, and called the architect Eupalinos from Megara to carry out this undertaking. Modern times have long been acquainted with this delicious source, three chapels of St. John now marking the site. One of these is built directly over the ancient reservoir, and this roomy structure, triangular in form, was nearly full of sweet, cold water when visited by Fabricius. Its roof, now the floor of the chapel, he found supported by fifteen square massive limestone pillars, arranged regularly within roomy walls of masonry, the whole giving the impression of great solidity and quaint antiquity. Doubtless, in older days, this work was well concealed, access to it having been known only to those who had charge of the aqueduct; for, as the reservoir lay far outside the city fortifications, had it been prominent or even exposed, the enemy could have cut off the supply. The water was conducted from the reservoir to the mouth of the tunnel by a channel partly cut in the rock, and partly built out with admirable masonry of polygonal stone, fitted together without cement; in the bottom ran large terra-cotta pipes. Work on the tunnel was begun on both faces of the mountain at once, and traces of the hacking-out with a pointed axe are visible along its whole length, except where secreting lime has made its deposit of centuries. This main tunnel, high enough for a man to stand in with ease, and wide enough for two to pass, while removing the débris they had cut out, has in its bottom another channel, where the pipes were laid. The walls and ceiling of this tunnel are not accurately finished, but there are frequent niches met with for the workmen's oil lamps, and some of them still hold the humble terra-cotta lamps left there so many ages ago. The tunnel in places is now obstructed by great stalagmite columns, but, happily the very spot where the workmen met in tunneling from opposite directions is accessible, and shows that those coming from the south struck a little too high, being obliged to deepen their end to make it exactly level with the one from the north. Besides this slight miscalculation, Eupalinos must have made one other. The deeper channel, already referred to, cut in the bottom of the tunnel for the pipes, indicates that he had to give the water a greater fall than was at first planned. Connected with the depths of this tunnel are three solemn chambers in which seats are cut. Were these apartments where night ever ruled the tyrant's prisons? Gladly we turn from them to the ruins of a Christian shrine, also in the midst of this subterranean work. A part of a trough, doubtless built to catch the water dripping from the walls, indicates the reason for choosing such a site. That this mysterious water was considered holy and wonder-working appears from a similar trough still used to catch the sacred drops in a rock-shrine near by, at the small cloister Panagia Spilani. The spot where the water actually entered the city has, unfortunately, not as yet been found, but according to an inscription now in Tigani (ancient Samos) there were in olden time in the *stoa* bordering the *agora*, two clocks, which told month, day and hour, and were driven by water. One of these clocks had the shape of a bronze dolphin, from the mouth of which the water flowed, and it is most probable that here in this *agora* it was that the waters of the famous tunnel found their goal. Although Samos's famous old water-works are much in ruin, still their preservation is sufficient to induce the present Prince of the island, Constantinos Adosidis, with an energy and courage worthy of his great predecessor, Polycrates, to bring the abundant, health-giving stream again through the old tunnel to his seaport Tigani. For this purpose the cumbrous terra-cotta pipes of Polycrates's days, fastened together with white cement, are being replaced with iron pipes, and the work of clearing out the choked-up passages, and removing the intruding stalagmites and other obstructions is being energetically prosecuted.

While the plan of the late Roman baths has long been well known, those of Caracalla and Diocletian being good samples in Rome, the Greek bath of an earlier day has until within a short time been a mystery. But the recent examination of certain ruins long known in Assos, Alexandria Troas and Ephesos has at last proved that these were baths and not centres of athletic sports, as formerly believed. Neither plan nor finish in these Greek structures was as elaborate or luxurious as in those built by the Romans. An exact account of the oldest, and no doubt, most interesting of these Greek baths is promised us by our own Archæological Institute, which carefully investigated the site during its excavations at Assos. As yet we only know, however, that here no great basin for plunging and swimming existed as in Rome and Pompeii, but that the simple douche, or pouring on of water and washing at bowls, made up the luxury of bathing with the older Greeks. No extensive and elaborate apartments were found in the Assos bath, the main room being a long narrow hall about five metres wide and sixty-eight in length. Along its walls stood many wash-basins, the standard of which have been found. At Alexandria Troas the remains, carefully measured by Koldemy, are, however, somewhat more elaborate; but still the main feature of the structure is the long narrow hall for washing, etc. These rooms are indeed more numerous at Alexandria Troas, while still other apartments, as yet unexplained, are attached to them. The entrance was grand, being decorated with pillars; the interior walls were lined with varied marbles; Lesbian rosso from Africa, cippoleno and serpentine being now scattered on the ground. Iron and copper clamps in the walls indicate the former mode of attachment; a substantial mosaic pavement finished the floor, while glass mosaic lined the arches spanning the halls. A square pillar, in which the pipes still run, furnishes interesting evidence that through this the water was pumped up into a reservoir from whence it was distributed. Niches for wash-basins were found, and pipes and openings show, besides, that once the refreshing douche played from along the walls, about a man's height above the ground. Thus, very ancient vase paintings where bathers stand under the cooling stream and scenes in many a Constantinople bath of to-day seem to find analogies in this bath ruin of Alexandria Troas. Such, moreover, is the technique of the marble as well as the style of its cornices, that Koldemy considers the bath to be cotemporary with the exedra of Herodos Atticus in Olympia.

All those interested in the puzzling growth of the topography of Rome and the relation to the Servian of the equally old, if not older, walls found recently, within a smaller limit on the Celian, Quirinal, and Palatine, will read with attention Richter's account in the last "*Annali*" of the fortifications of Ardea. These seem to mirror a process which may also have taken place at Rome, for as it grew, the small colony on the Rock of Ardea extended its fortifications twice, and as the city sank again the borders contracted to their original extent. Besides such reports, concerning public and religious architecture, we have also disclosed the interior of a large patrician Greek house at the Piræus. In Pompeii, in a provincial Roman dwelling,

closets in the wall have been found, it may be clothes-presses or pantries, thus giving some light as to the modes of house-furnishing in antiquity, while the now uncovered shelves of an apothecary's shop, with bottles, make clearer the arrangements of trade life.

In the department of sculpture the present publications bring much fewer objects of interest, but among those of prime importance for the history of sculpture are several archaic pedimental groups, found in Athens, doubtless over the decoration of very old temples. The illustration in the "*Mittheilungen*" show us that here, as in all very ancient Greek art, whether found on vases, bronzes or stone, the story of Herakles's great labors occupied pre-eminently the artists' fancy. In these remarkable archaic sculptures we have Herakles fighting the dread Hydra, its cruel, snaky body and venomous heads filling up one whole half of the pediment, and calling to mind a similar repulsive rendering of the subject in one of the metopes of the Zeus Temple at Olympia. In another pedimental scene Heracles wrestles with the great sea-god Halios Gerun, as in the sculptures at Assos. The faithful charioteer Iolaos stands by in the hero's chariot, looking back at the dreadful contest, while the horses sniff curiously at a crab, fabled in poetry to have assisted the sea god, but put here to fill up the vacant space, and consequently shoved off into the corner of the pediment. The material here, a coarse conglomerate interspersed with sea-shells, is little suited to carving, and there is consequently, besides the awkwardness natural to infant art, a helpless struggle with the stone used, leaving the relief exceedingly rough and uncouth. To help out, color is freely used, but, contrary to all other archaic sculpture, and in harmony with the spirit of the early vases, the figures are painted dark, to stand out against a light background. Of the third archaic pediment only one fragment has been found, but this, like some very archaic reliefs in the British Museum, represents satyrs and mænads, and no doubt belonged to the pediment of some very old temple to Dionysos, as this fragment was found in close proximity to the theatre of that god. Within a few weeks past, as Dörpfeld kindly informs me, he has come upon an old temple of Dionysos near by this theatre, a fact which strongly supports the above conjecture. In these three pedimental groups, which, like the one of the Treasury of Migara at Olympia, are all in relief, we have clearly some of the earliest attempts made by the Greeks to adorn the pediments of their temples. How far down the stream of history seem in contrast the statues of exquisite Parian marble, carved fully in the round, with which the Æginitans decorated their temple! and yet but a few years ago we looked upon these strange, smiling figures from Ægina as representing the oldest pedimental groups of the Greeks.

Did space permit, much might be said of inscriptions found relating to the great Lysippos, of the light thrown upon Attic tombstones of Phidias's time; we might go into the developments of Cypriote art, and for Roman art tell of the wealth of new material found in the cellars of the Villa Borghese; but for all this I must refer readers to the interesting pages of the "*Mittheilungen*" and "*Annali.*" I cannot, however, pass in silence some remarkable discoveries in the department of ancient topography. Familiar to us from childhood has been the story of the quaint grotto in Crete where the infant Zeus was born. Often fancy has heard the din of arms made by the graceful corybants at the mouth of the grotto, to drown the cries of the babe god within, that his voice might not reach the lowering Kronos, eager to drown the child who should one day rob him of his throne. We have heard of the faithful goat Amaltheia, also, who, suckling the god in his infancy, gave him strength to become the great Zeus, and herself was immortalized. Plato is one of the earliest writers to refer to this spot, and as in one of his dialogues he makes his three talkers wander from Knossos to the grotto on Mount Ida, we feel that it must have been a beautiful pilgrimage they took in the summer days. Theophrastos tells us that the grotto was full of votive gifts, and Diodorus dwells upon the fields round about, upon the bees that nourished the god here. And now this very grotto on Mount Ida has at last been discovered by Fabricius. On about the highest summit of the mountain is a great plateau, dotted with springs and covered with rich pasturage. Trees are to be seen only near the springs. Terrific storms tearing up and laying low many of the fallen monarchs, the fallen, seared trunks combine with the wild, free landscape to stimulate the fancy of every one privileged to wander here. Near one of these springs is a grotto, where shepherds have long sought shelter for their flocks. Above it rises a perpendicular wall of rock, forming, with the distant pastures, the peaks and scattered trees, a scene of peculiar picturesqueness. In front of this grotto the shepherds were led, for some reason, to dig, and Fabricius found in their hands antiquities of so varied a nature that it was evident that here had been a shrine visited from very remote ages down to the Roman time by worshippers bringing gifts. By those of oldest days were brought, no doubt, the quaint tripods and other sacred vessels, with geometrical decoration exactly like those found in the most ancient parts of Olympia, in Dodona, and in Delos, and thus proving their great antiquity. In the grotto, where even in September the snow which had outlived the summer heat was still lying, were found more than one hundred clay lamps of Roman make, besides ashes and bones from sacrificial fires, all, no doubt, from the secret service of the mysteries. Besides all these there was a figure of a goat, perhaps Amaltheia, so honored as afterward to be deified. Outside the grotto, pedestals bearing traces of the bronze feet of statues which had once decorated them, as well as the broad surface of a rock smoothed-off for an open-air altar for burned offerings, were found. Fabricius's happy supposition that this is the Zeus Grotto of antiquity has since his visit been confirmed by an inscription recently found on a terra-cotta fragment there.

For clearing up the ancient geography of Asia Minor, the English scholar Ramsay has brought forward many valuable points, but, no doubt, for the weightiest contribution concerning Isauria, Eastern Pisidia, and other parts of Central Asia Minor, we must look to our own countryman, Sterrett, who, with the untiring zeal and self-sacrifice of a true traveller, has opened up hitherto unknown regions. The much-disputed site of ancient Tavium, that key to the network of great roads in antiquity traversing Asia Minor, has been finally settled by this intrepid Virginian, and the sites of Lystra and Nea-Isauria discovered, to say nothing of river-courses corrected; and much more. Lystra is too intimately connected with the story of Paul and Barnabas to be unfamiliar to readers of the Bible, but Nea-Isauria has only most recently taken actual form. Scarcely had Dr. Sterrett discovered the site, finally dispelling serious doubts always entertained as to its very existence, when there was brought to light by Dr. Hallor, in Paris, a Sallust manuscript in which many new and startling facts about Nea-Isauria were found recorded; and thus the work of these two devotees of science is found to be absolutely harmonious and necessary one to the other. Frequently, Dr. Sterrett tells me, as he copied an inscription, or appeared to be drawing a map, he did not know whether he would be allowed to live through his work, the suspicious natives threatening his very life with their guns. The maps of his explorations, upon which he has been engaged this summer, are being made by Kiepert, a sufficient guarantee of their excellence, and it must have well repaid Dr. Sterrett to hear Kiepert's delighted exclamation, "You have made the map of Asia Minor," for the opinion of this eminent geographer is one of highest value. The report of these explorations will appear in the publications of the American School of Archæology.

Turning to the light thrown upon history by the new publications of the Institute, we hardly know which subject to take up and which to pass by, so rich is the fund. Athenian families are pictured to us here as we have been accustomed to see delineated only Roman patrician houses; the far-sighted policy of Solon in changing the Athenian coinage is unfolded to us with such clearness that we almost believe that Athens's trade with Italy demanded this revolution, and certainly Solon's desire to secure the prosperity of Athens was attained, if we may judge from the signs of Athenian supremacy in Italian commerce, a supremacy which by the fifth century B. C. seems to have crowded dangerous rivals, and especially Corinth, out of the field.

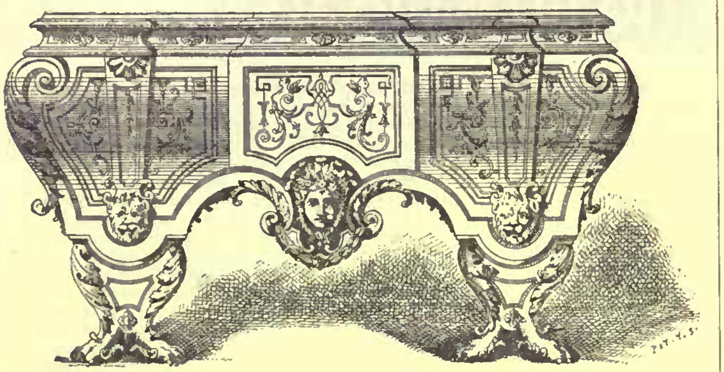
Washerwomen we are not wont to think of as making up any mentionable part in old Greek history; but otherwise teach the inscriptions. There they appear as worthy members of society, doing a share in making offerings to the gods, and this as early as the sixth century B. C. A standard found under the Parthenon débris, and conjectured by Köhler to have held a utensil for besprinkling with holy water, bears the few but telling words, "Smieythe, washerwoman, dedicated a tenth." The fact that of all the trades besides physicians, actors, only washermen and washerwomen are specially designated in the inscriptions seems to indicate the importance to the old Athenian State of even this humble class of carers for the public weal.

What the "*Mittheilungen*" do for Athens, the "*Annali*" and "*Bulletino*" do for the history of Rome. As we hear Hinzen tell of the guards (*frumentarii*) posted around about Rome in the days of the emperors, to prevent brigandage, we are reminded of the gay horsemen that to-day patrol the Via Appia. But the numerous clocks and church-bells of modern Rome must be very different from the time-pieces of the olden time. At first the Romans, perhaps because so absorbed in war, paid little attention to the accurate division of time. Even sun-dials were not known among them as late as the time of the Punic war, the time of day being called out at regular intervals by criers, reminding us of the noonday cry of the muezzin, from the Moslem minarets. Their first sun dial the Romans got from the conquered Greeks in Southern Italy, but seem to have been no less ignorant of its use than they were incapable of appreciating the beauties of Greek art. They put it up in the Forum, imagining that it would serve its purpose quite as well in the changed latitude. For a full century this old time-teller had to do duty, only giving place to a truer one when the Romans had been educated up to a better knowledge by the people they had enslaved. In time sun-dials were found to be such a convenience that they were set up in public squares, baths, in houses and temples, multiplying so rapidly that by the seventh century of the city she could call herself "*oppléta solariis.*" Varro describes one of the older sun-dials, known to the Romans at Palestrina, as bearing on its face, not the usual inscription, *Meridies*, but the archaic *Medidies*, and it is of great interest to know that, though as a matter of course much of this old dial, with its inscription, no longer exists, Marucchi has succeeded in showing on the mid-day side of the cathedral a large part still extant, certainly far older than all other similar monuments and far simpler.

Far more might be said here as of vital interest to all friends of antiquity, and, indeed, of humanity, about the descriptions of Mycene-like graves in Thessaly, about a painted tomb in Tanagra, about vases with strange archaic or with beautiful artistic scenes, and

about vast necropoli pouring out their treasure, but space is limited, and the reader must be pointed to the head sources themselves.

AN ARCHITECT'S HUNT AFTER A SMELL.



SOME months ago I was requested by a client to take in hand and thoroughly overhaul, in accordance with more modern ideas, the sanitary arrangements of a house he had just taken on a long lease, and forming one of a terrace in Regent's Park. What I directed was well carried out by a builder accustomed to work of that nature. It comprised the removal of the water-closet from a central position in the house, the finding out and removal of a disused brick-drain at the rear, and the thorough ventilation, inlet and outlet, of the whole drainage system. These, and other operations which I need not mention in full detail, occupied a couple of months, and at their termination my client moved into his new home. He had barely been there a week when he wrote to me, complaining bitterly of a smell that had asserted itself in the house within a day or two of his entering, and the source of which was undoubtedly in the bath-room.

To make all clear to the reader, I may here briefly describe the plan and arrangement of the house. It formed No. 99 of the aforesaid terrace, and its next-door neighbor, No. 100, was on the hall and staircase side of it. The basement floor had a passage under this hall, and a door going into the front area, underneath the steps leading to the front door. The ground floor consisted of the hall, a dining-room to the front, a library behind it, and a couple of rooms, and a w. c. built on as a kind of annex at the rear of the house. The first floor was given up to a large front and a smaller back drawing-room. On the half-landing between this floor and that above was the new w. c., substituted for the old and internal one. (All the pipes — supply, ventilation, and soil — in connection with this were external, as the w. c. itself was carried on cantilevers on the outside of the main back-wall of the house). The second floor contained two bedrooms — front and back. The former was in connection with a dressing-room, fitted in the previous tenant's time with a bath, and one of its walls was that I have referred to as the party-wall dividing us from the next house. This was the room whence the nuisance, of which great complaint was justly made, evidently arose.

The smell was compared by various independent investigators to that of a newly-used w. c., but had withal a hot, close, sulphury element in its composition. It was capricious as regards the times of its occurrence, but was, as a general rule, at its maximum about midday. The bath-room was in size about twelve feet long by eight feet wide, with the bath itself at the door end of the room. Curiously, we found the smell far more intense in that corner farthest away from the bath, *i. e.* in the angle formed by the external wall and the party-wall. I first satisfied myself by a careful examination of all pipes in connection with the bath and of the lead safe tray under it, that there was no possible reason for laying the blame on any of these.

This point clearly proved beyond a doubt, I then proceeded to attack the corner near the external wall and window. The architrave and linings of the latter were removed, and immediately this was done a strong puff of hot fœtid smell was perceived. But no cause presented itself. The floor — a "pugged floor" — had then the boards removed in this particular part of the room, and the wooden skirting of the party-wall was taken down. This last action seemed again to release a "pocket" of stored-up smell, and led to our removing some of the plaster on the same wall. The brickwork was, I found, rough work, as regards the nature of the bricks, and the mortar joints were exceptionally bad — discolored and of so soft a bind that a chisel could be pushed up to its handle in most of them. On trying close to this part of the wall we found beyond a doubt that the smell entered the room here. It was the same thick sulphury smell, and — as my builder declared — had about it a suggestion of a dead and putrefying body. Acting on this suggestion, we set to on a hunt for the corpse of a rat or mouse, sepultured, perhaps, in some small recess in the wall, or between the joists of the floor. But to no end, and we further were enabled to assure ourselves that the smell "oozed out" of the joints of the brickwork.

The architect to the late tenant of the house was now invited to appear on the scene, and to aid us with any information as to the bath that had been added under his superintendence, or as to any other cause to which the nuisance could be attributed. But neither he, nor the builder who did the sanitary work under his directions some few years ago, could aid us with any light. The conclusion we (and another sanitary expert called in) came to, was that we were smelling smoke from next door. But investigations there did not confirm this. There was no fireplace immediately behind the centre of evil. Though still puzzled, yet under much relief at finding no possible reason for thinking that the bath and its pipes had anything to do with it, we resolved to thoroughly calk out the smell, and be content. This was done by clearing out the mortar-joints of the party-wall in the bath-room, repointing in cement, rendering this wall and the space behind the architrave and the window-linings in cement, filling up the space between the ceiling of the room below and the floor boards with pebble-concrete in cement, and filling in behind the skirting. This was finished by December 10. On December 23, my client writes me in despair, "Our work is thrown away; the smell in the bath-room and under the attic stairs adjoining is as bad as before we commenced operations."

On visiting the house when I received this disconcerting news, I found the smell pervading the whole of it in a very strong and noisome form. The drawing-room (under the bath-room, as the reader will remember) was now unusable. The dining-room had a bare trace, but in the basement passage the foul odor was extremely strong. This seemed to point to something being wrong, and acting as the prime cause, either on the basement floor or in the drain system. Our theory, then, was that, arising here, it was carried up to its easiest outlet by means of a flue. We were under the impression that in this party-wall we had only one flue — namely, that from the butler's pantry carried over the basement passage by a "flying flue." This we cut into, but found it free from any smell, and, on putting a pan of boiling water mixed with oil of peppermint at its base, we found no trace whatever of a peppermint smell in the bath-room or other affected rooms. Thus this flue was guiltless, but our researches in connection with it showed us the existence of another, of which we had had no suspicion. It started from a bricked-up fire-place in the hall, and we felt it our duty to submit it to the same tests as the other one. But again with no result.

Unable, then, to track the smell to its origin by means of a continuous channel, we fell back on the theory of its production by a defective drain. We accordingly laid bare and examined the earthenware drain-pipes in the basement. Beyond finding a regular old-fashioned piece of drain-work in the shape of a rain-water pipe from next door, running through the area party-wall, and discharging into *our* system — a proceeding we objected to and altered — there was nothing whatever to take exception to when our drain was laid bare to inspection. Yet there, six feet above the basement floor level, was *the* smell in full force. We now, therefore, having acquitted our own system, naturally accused that of our neighbor's at number 100. They also happened to "have the plumbers in," which gave facilities for making our inquiries. The state of their sanitary arrangements, whatever it was, need not detain us. Amongst other things we found the supply-pipe of their boiler leaked badly, and this was accountable for the great dampness of the party-wall just above the point to which we had tracked the smell. We were now getting "warm," as children say. Unable to examine our neighbor's kitchen fireplace as thoroughly as we wished from *his* side of the wall, we had to do so as far as we could from our own. For, as measurements showed now that it was situated just where "our smell" was tracked to, we felt it important to learn if it were responsible for this latter. And a brick knocked out of the four-and-one-half-inch backing of the kitchen fireplace of number 100 revealed to us that we were indeed near the end of our search, and had found the starting-point and cause of the nuisance that we had been hunting for so long. The mortar-joints were full of larvæ and full-grown beetles. These, though many, were not enough to cause so great an effect. But further hacking away the wall proved that the flue, after being "gathered over the opening, dipped down again and formed a pocket impossible, or nearly so, to sweep and clean out. This was *full* of the bodies of dead, putrefying, baking black beetles mixed with smouldering soot. And this was the origin of "the smell" — an ignominious discovery may be, but still an experience that it is not, perhaps, useless to set on record.

Little could be done, by the way, to effect its cure. Our neighbor's experience as to his own drains had so wrought upon him that, Pharaoh-like, "he hardened his heart," and objected to having "any more men about the house." But, having found no reason to fear typhus from bad drainage, we were, at all events, much relieved in mind; a cast-iron pipe now leads *most* of "our smell" direct from its source to the open air, and it no longer finds its way, in full force, up the next door flue, and thence by defective joints into my client's house. — *C. Harrison Townsend in the Sanitary Record.*

SCAFFOLDING IN A CHURCH EIGHTEEN YEARS.— Phillip Igle & Co., of Reading, have just finished frescoing Gernant's church, near Leesport. The building of the edifice was commenced nearly twenty years ago, and eighteen years ago it was so far completed that the scaffolding was put up on the inside for the plasterers. Then the congregation worshipped in the basement of the church these eighteen years, the scaffolding remaining up in the main audience room until the recent frescoing was completed, when it was taken down, — *Allentown, Pa., Item.*

COMMUNICATIONS

NORWAY PINE *VS.* SPRUCE.

Newark, N. J.

To the Editors of the American Architect:—

Dear Sirs,—A question has arisen as regards the relative strength between Norway and spruce timber when used for beams. If in your power to give us any information on this subject we shall be very much obliged. The Norway in question comes from the northern part of Michigan, and is used largely for building purposes in the West. The spruce with which we wish to compare this comes from Maine. The Norway is well seasoned, and was cut nearly two years ago, while the spruce is of this year's production. Messrs. Stahlen & Steiger, architects of this city, suggested that you might be able to give us the needed information. The size of timber in question is 2″ x 12″ x 16′. Yours respectfully, J. S. H. Clark & Co.

[According to the tables given in Rivington's "*Notes on Building Construction*," the wood of the American red pine (*Pinus verbra* or *resinosa*), which is known locally in this country as Norway pine, has only about two-thirds the transverse strength of spruce. — Eds. American Architect.]

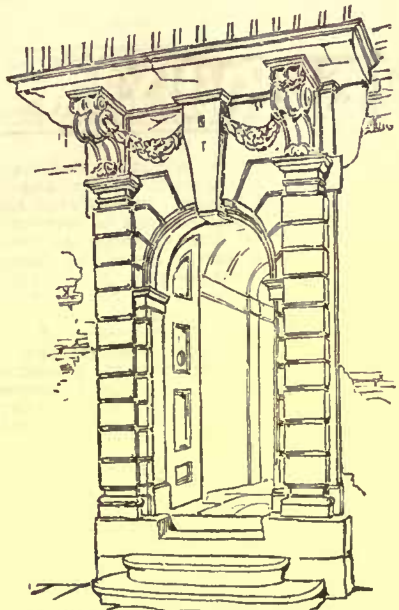
NOTES AND CLIPPINGS

Investing in Winzes. — It is safe to say that three-fourths of those who deal in mining stocks through the medium of the boards never saw a mine, and that less than one-half have any knowledge of how a mine is worked. That people should make serious mistakes in their speculations through ignorance of these matters is not to be wondered at. Perhaps the greatest blunder on record was made by a gentleman of decided Teutonic origin, who visited my office one day and asked, point-blank: "Haf dey schtruck dot vinze?" "What winze do you refer to," said I. "Dot vinze in the Oonion Consolidated mine," was the ready response. "There's no winze in the Union Consolidated mine that they are likely to strike at present," I answered, and then, thinking the man might be a little confused in his mining knowledge, I asked: "What do you mean by a winze? What do you suppose a winze is?" "A vinze," he shouted, with a knowing smile, "oh, a vinze is a body of ore." "No it isn't," said I, and, taking a pencil, I drew him a little sketch of a winze, and explained to him that it was a small shaft sunk from one level to another, generally for the purpose of ventilation. "Is dot a vinze?" he fairly yelled, in the most astonished manner; "den, by gracious, I lose me tousands und tousands of dollars on dose vinzes. Every dime I see dey have started a vinze, or schtruck a vinze, I buy der schtocks, and every dime dey go down right avay. It always was a wonder to me why de Comstocks didn't pay more dividends and levy fewer assessments ven dere vas so many hundred vinzes in der mines." He walked out, leaving the door open, and I could hear him repeat at every third step as he went down the stairs: "Oh, dose vinzes! Oh, dose vinzes!" — *San Francisco Argonaut.*

The Bells of St. Michael's, Charleston, S. C. — "The Church of St. Michael's," said Comptroller Trenholm to a *Post* reporter yesterday, "was looked upon with veneration by the inhabitants of South Carolina as a memento of old colonial days. It was built at the commencement of the eighteenth century after the designs of a London architect, a pupil of Sir Christopher Wren of St. Paul's Cathedral fame. Sir Christopher himself suggested many of the features, and the design bears a general resemblance to that of St. Martin-in-the-Fields, facing Trafalgar Square, in London. The spire was noted as being one of the finest specimens of architecture in America. The bells of St. Michael's have a curious history. They were originally manufactured in England, and were a gift to the colony. When the British, during the Revolutionary War, captured the city they took the bells, and on their evacuation they packed them up and sent them to England. After the treaty of peace had been consummated, negotiations were opened in London for the return of the bells by the first American Minister to Great Britain. He succeeded, and the bells were sent to Charleston, and upon their arrival were received with triumphant ovations, and escorted by a large procession to the church, in the belfry of which they were replaced. During the late Civil War the citizens of Charleston were desirous of protecting the bells from danger, and, as the steeple of St. Michael's was made the target for the cannon of the besiegers, the bells were taken down and sent to Columbia for safe keeping. When Sheridan's army took Columbia the shed in the yard of the State House, in which the bells had been placed, and which also contained the marble friezes and other sculptures intended for the decoration of the Capitol, were broken in and the sculptures and bells were smashed into fragments, and the sheds were then set on fire. At the conclusion of the war the pieces of the bells were carefully gathered together, boxed, and shipped to the commercial house of Frazier, Trenholm & Co., of Liverpool, together with extracts from the records of St. Michael's, showing where the bells were cast, and the proportions of the metals forming their component parts. Upon inquiry it was found that there was still in existence in England the firm of bell-founders, unchanged in name, and consisting of the descendants of the proprietors at the time the bells were made. The records of this firm contained descriptions of the bells, and the proportions there given were found to correspond with those furnished from Charleston. The bells were made anew, therefore, of the same metal, and for the fifth time they were carried across the Atlantic, and arrived safely at Charleston. Their return was made the occasion of great rejoicing in the city." — *Washington Post.*

TRADE SURVEYS

Every week develops some additional indications that the country is about to pass through another era of unusual activity, and possibly, of higher prices. The leaders in trade, industry, transportation and finances, are, as yet, not apprehensive of an undue stimulus to production, such as would precipitate artificial prices, and thus jeopardize the broad prosperity visible on all sides. At the same time we are in some danger. If we are the danger will be short-lived. Four years ago it produced disastrous results. Fourteen years ago it was followed by a five or six years' panic. It is not, therefore, surprising that the commercial and manufacturing world is afraid of any sudden or unprepared-for expansion of demand. The productive capacity of the country is equal to all probable or possible requirements. Special causes have contributed to the present exceptional activity. One was last spring's strikes. The monetary interests, in the particular shape they have taken during the past twelve months, have had something to do with it. The production of raw material has not kept pace with the expansion of demand. Stepping for a moment into an outside field, in order to illustrate, we find a general shortage in the Australian and Montevidean wool supply. Prices have consequently advanced in Australian, European and American markets. Before the Western world was apprised of the danger our American markets were filled with European cloth, and in consequence, our American manufacturers have been obliged, during the fall trade, to sell the products of their looms at low price, in competition with imported goods. The entire world is getting ready for an advance on spring goods, due to high-priced wool, and higher-priced labor, supplemented by an extraordinary demand, the foundation for which has been laid during the past few months. Even cotton is sympathizing. Textile products generally will, in all probability, command higher prices next spring and summer. Hides, leather, boots and shoes, are also threatened with improving prices. Then, again, the possibility of a fresh strike agitation is to be kept in sight. But the probabilities in that direction will be more clearly discerned upon the adjournment of the Knights of Labor Convention which meets at Richmond next week. Should a fresh agitation be precipitated upon the country, it will produce very undesirable results in many directions. It is not often that wide-spread labor agitations are followed by beneficial results, but this year's agitations are somewhat of an exception — the reasons for which have been heretofore given. The immediate effect of such an agitation, or even its announcement, would be to arrest hundreds of projected building, railway, and manufacturing operations. It is probable that labor is intelligent enough to not jeopardize the expanding prosperity by any such action. The building-trades have been accorded their nine-hour demand and their higher pay, and as they, as a body, mostly stand in a separate organization, outside of the Knights of Labor, they will probably decide this matter for themselves. The Knights, however, are a conservative body — at least, have that reputation — and, in the last agitation, took no hand whatever, leaving it to the isolated trades-unions, to which the members of the building-trades generally belong. The same upward tendency is observable in several other branches of industry. In iron and steel making prices have advanced about $2 per ton in muck-bars, bar-iron, tank, plate, shell, and in one or two shapes of bridge-iron. Cast and wrought pipe have reached their highest probable limits. Steel rails cannot advance much higher because of threatening importations. Old rails have gone up as high as $22 per ton at tide-water, and there they stand. Steel rail-blooms have advanced to $26, at which figure they are $1 per ton beyond the reach of buyers. Crude iron, including foundry, forge, and Bessemer, is about advancing 25 to 50 cents per ton, even under an enormous production, amounting to over 120,000 tons per week. The same tendency is observable in other industries. The price of anthracite coal has been advanced 15 cents per ton, October 1, and a further advance will take place in November, and probably in December. While, as yet, there has been no advance in lumber, firmer prices are being realized for hardwoods, especially walnut, the best grades of which are being largely exported. Under these influences it is not at all surprising to find a general anticipation of a higher range of prices all along the line of industry. It is possible that this advance can take place without producing any very harmful results. The conservatism and experience and foresight of the managers of our industries can avert evil, if the lessons of experience are not well learned, it is possible for us to rush into the quagmire which arrested our progress for so many years. But there is no use in borrowing trouble. There is not an industry that can be named but which is prosperous. Labor is getting the biggest slice, but capital, under the strong competition for opportunity, is content with the moderate share it is receiving. The ultimate outcome will be, that building activity will be greatly stimulated. The higher wages and general employment help to create a desire for homes, and this desire is the foundation of our great house-building activity. Some of the most careful thinking men in the country have quite recently reiterated previously-expressed opinions that the year 1887 will be a repetition of 1886, with this advantage: that margins will be wider, and that capital will be more fully employed; and that production will reach its maximum limits. The same opinion is entertained by some of the best building and money-lending authorities in the West. As long as capitalists are willing to shower their money into new enterprises, so long may we rest content; but frequently, money-lenders are blind to their own interests, and throw millions upon millions, where it is soon lost or absorbed. Such has been the case several times in our railroad-building experience. Yet the greed of the thousands who desired to become suddenly rich laid the basis of our great railway system. Had railroads only been built as fast as there were assurances of immediate and sufficient returns, there would not be more than half the railway mileage there is to-day. The hungry investors everywhere tossed their savings into the arena, and our railway system grew up in the ownership of the shrewd manipulators of values. The result of this has been to create a wholesome fear of railway speculation, and to crowd money in other directions. The supply of money will soon be much greater than it now is, and this supply will be one of those coming factors which will help to settle the labor question, in a way which neither employers nor employed are at present anticipating. In whatever department of industrial activity we look we discover healthy signs. There are very few indications that production will exceed reasonable limits. Small industries are springing up, and the wage-workers are, with few exceptions, well employed at wages which guarantee a heavy demand.

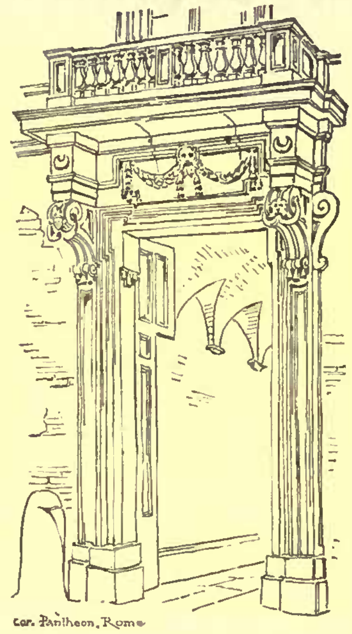


Via Gregoriana, Roma

Italian Doorway from sketch by the late Sir Digby Wyatt. Lond.

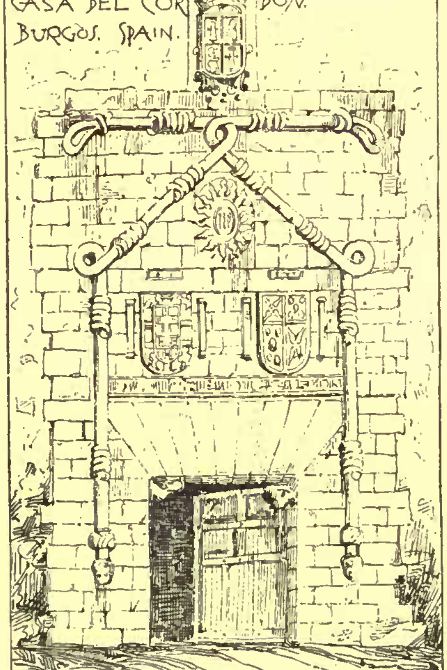


House in Bruges: Belgium:



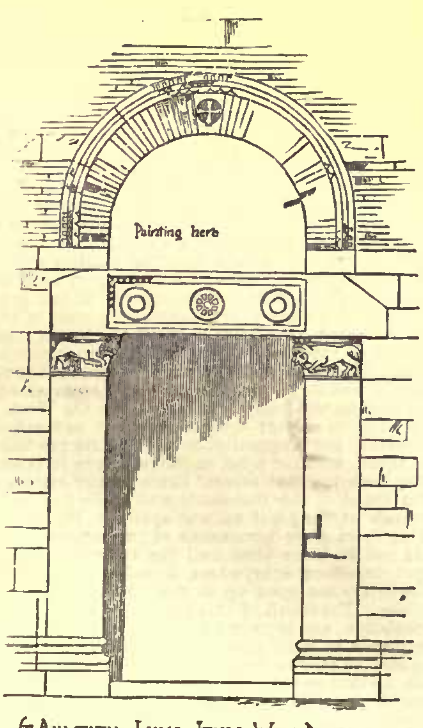
Cor. Pantheon, Roma

Italian Doorway from sketch by the late Sir Digby Wyatt. Lond.



CASA DEL CORDON. BURGOS. SPAIN.

REPORT CEN. SOC. ARCH'TS. PARIS.

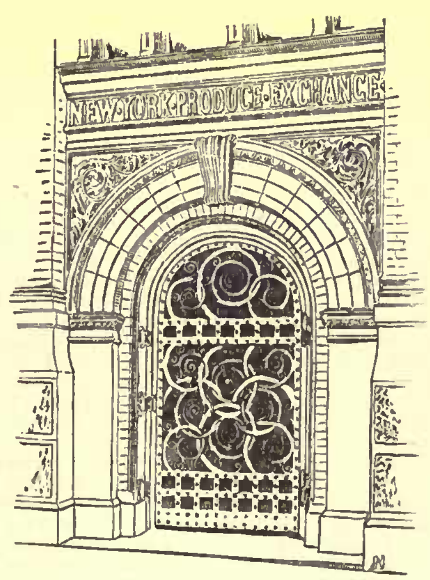


St. Anastatia Lucca, Italy, West Doorway.

After Lawson A.A. Sketch Book.



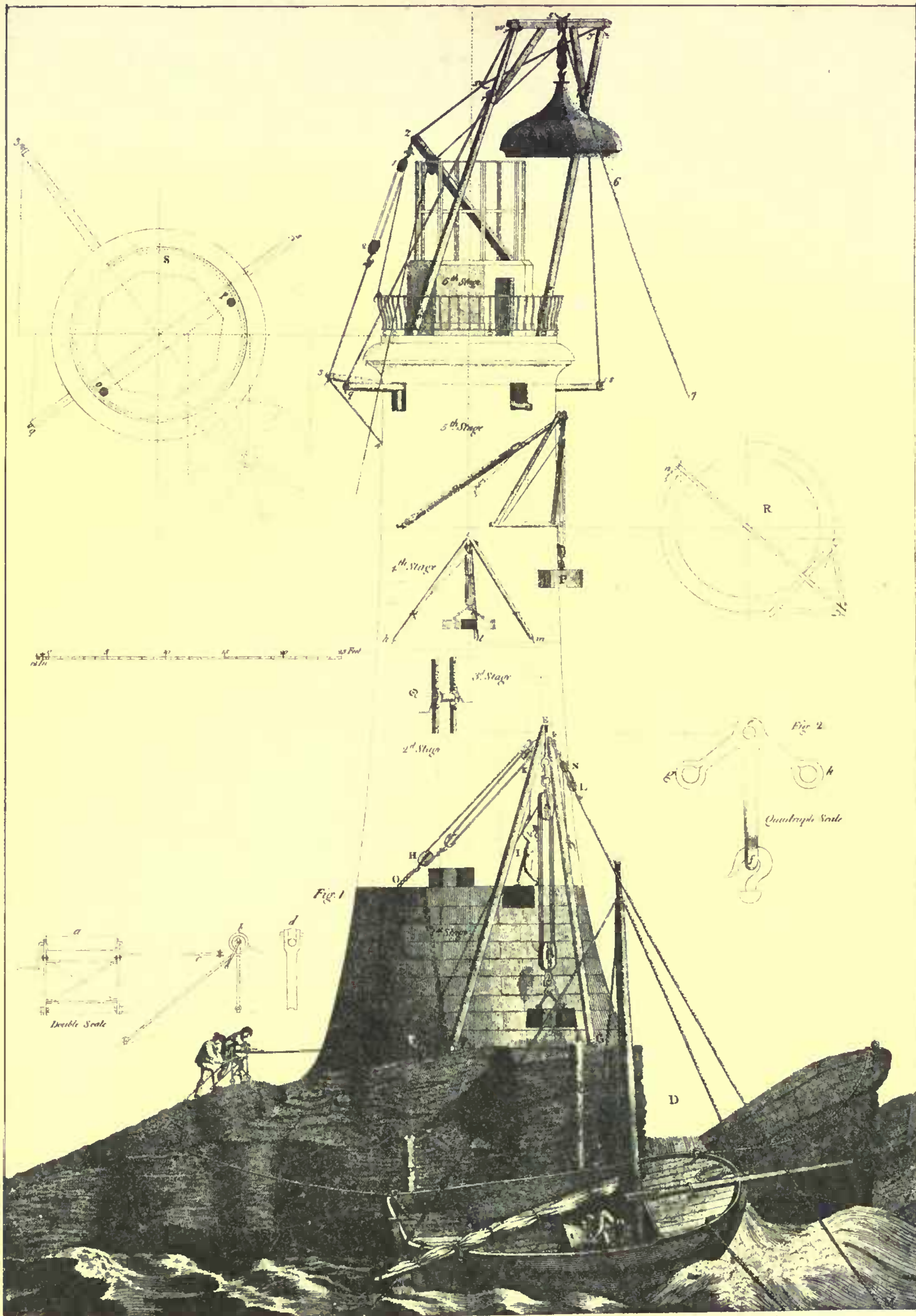
Doorway of the Chateau d'Ussé.



Street Entrance of the Produce Exchange

George B. Post, Architect. New York

DOORWAYS.



A View of the **ROCK** *on the* **EAST SIDE,** *and of the* **WORK** *advanced to Course* **XV.** *being the first of the* **ENTRY COURSES,**
Shewing the manner of **LANDING** *and* **HOISTING** *the* **STONES** *&c. in every Stage of the* **BUILDING.**

The Figures by Mr. C. R. Ryley. *J. Record sculp. 1786.*



HINTS, & SKETCHES,

from whence the FORM *of the*

PRESENT BUILDING *was taken.*

J. Record sculp. 1786.

Fig. 1.



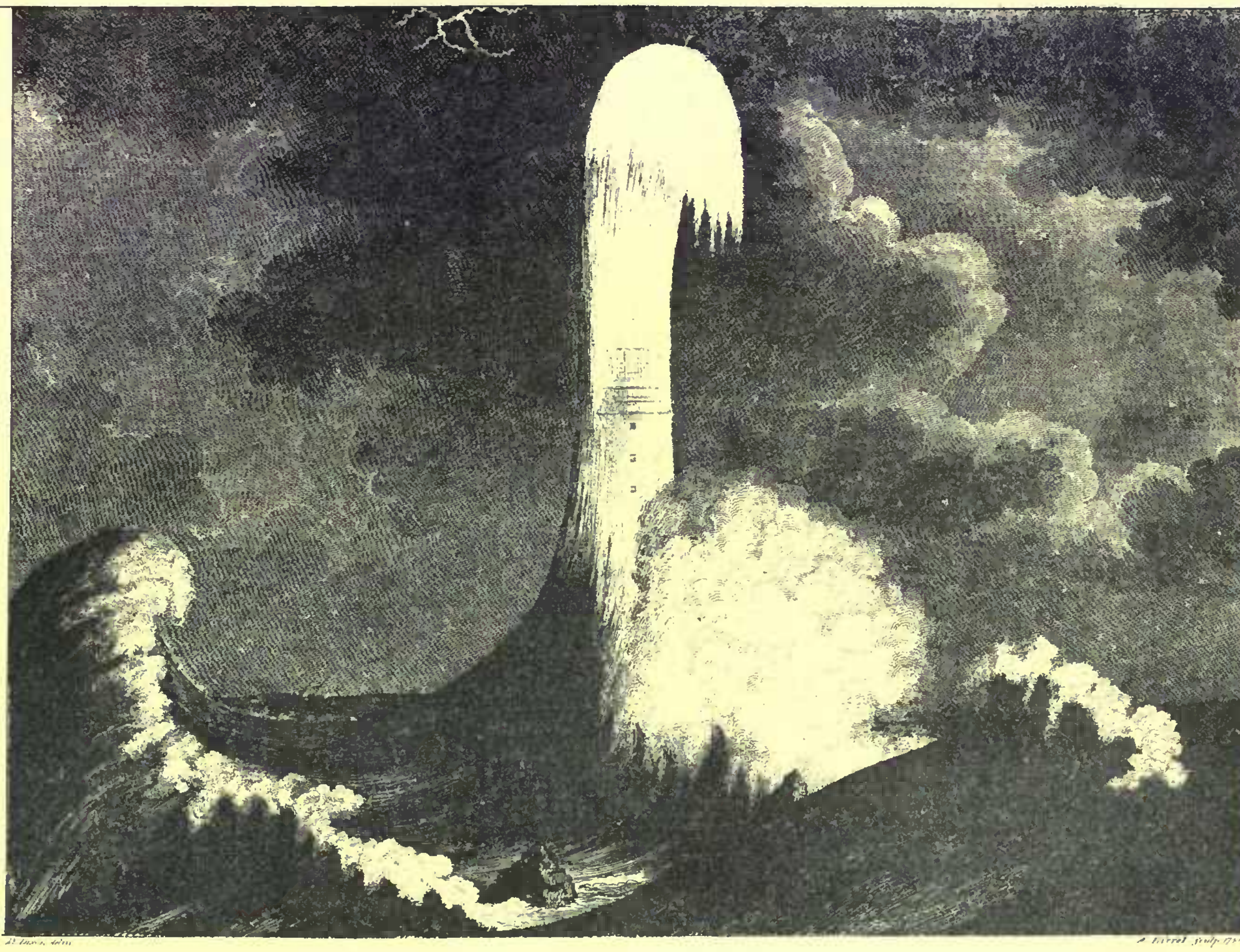
Fig. 2.



South **ELEVATION** *of the* **STONE LI**

Shewing the Prospect of the nears

TICKNOR & CO.







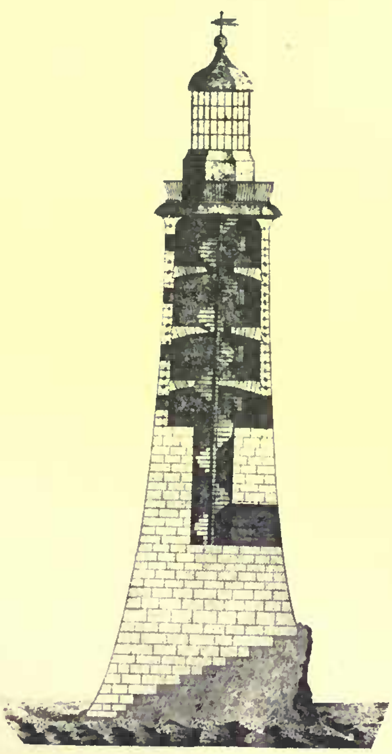


Fig. 4

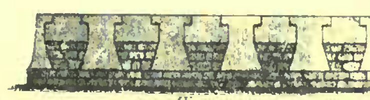
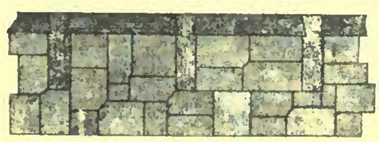
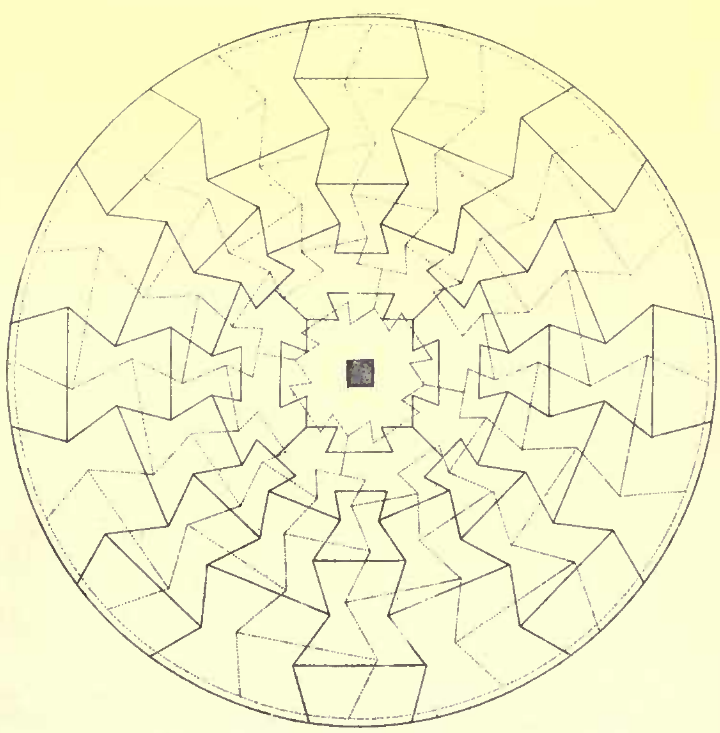


Fig. 3.





OUSE *completed upon the* EDYSTONE *in 1759*

it appears from the Rocks in a clear calm Day.

Engraved in the Year 1763, by Mr. Edwd. Rooker, The figures by Mr. Saml. Wale.

Heliotype Printing Co Boston.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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CONTENTS

NOT long ago the Boston Master-Builders' Association, in the hope of providing for the coming season against such a strike as that which nearly ruined them and their workmen last summer, held a meeting, to which all the principal architects of the city were invited, together with owners of real-estate, to consider methods of resisting the tyranny which the unions exercise over them and their men. As a result of this meeting, the Association adopted and published certain rules, which we print in full in another place, and commend to the attention of architects and builders everywhere. The first of the new rules, which directs that for the season of 1887 all workmen in the building trades shall be paid by the hour, at a price to be agreed on with each workman individually, and shall be at liberty to work nine hours a day, or longer, with extra payment for extra work, is professedly intended to test the question whether ten hours' work is more than the average man, not overawed by the unions, is really willing to do in a day, if he can get paid for it. If the liberty given to the men of choosing whether they will work ten hours or nine results in showing that the greater part of them really prefer to work the shorter time, and give up the money that they could earn by another hour's exertion, in order that they may have more time to improve their minds, the contractors promise to be satisfied with the day of nine hours, and even to consider the question of reducing it still further, if that should be thought desirable. If the contractors are permitted by the unions to carry out this plan peaceably, which does not appear to us very likely, it is quite improbable that there will be any occasion to try the effect upon the minds of the workingmen of shortening the day to eight hours. We need hardly say that if free from the constraint of the union rules, we doubt if any workingman of ordinary ambition or intelligence, whatever may be his ardor for that culture which, according to the labor-reformers, he longs so passionately to possess, would dream of giving up a quarter of the income which he might earn, for the sake of having, after deducting the time necessary for eating and sleeping, seven or eight hours a day of elegant leisure. That the other argument of the labor reformers in favor of short working hours, that by diminishing the amount of work done in a given time they increase the demand for men, and enable those to get employment who would otherwise find none, would have any weight with persons as clear-headed as the better class of New England mechanics, if they were not under undue influence, is still less probable than that they would feel an overpowering need of spending eight hours a day in studying the Divina Commedia, or the Transformation of Coördinates. No amount of sentimentalism can disguise the fact that an attempt by the unions to reduce the working day to eight hours for the sake of increasing the number of men to be employed is simply organized robbery of the men who are willing to work ten hours a day, and are skilful and sober enough to find employment, for the benefit of the idlers whom no master would be willing to hire if he could get his work all done by better men. It may be that the drunken, the vicious and the dishonest workmen need charity, and their families, at least, are likely to have some claims upon the humanity of their fellows, but no one has ever yet reproached American mechanics with being indifferent or niggardly toward those who require their help, and they can, undoubtedly, be trusted to bestow their kindness upon the proper recipients, without having the unions intervene to deprive them forcibly of a part of their income, to give it to those who probably deserve it least; but it is very unlikely that the leaders of the labor organizations in Boston will abandon willingly the claim which serves most effectually to attach to them their most servile and unscrupulous followers, and a struggle over the matter is probably inevitable, either between the masters and the unions, or between the tyrants of the unions and their more independent subjects.

THE Master-Builders' Association promises to protect men who wish to work, in case a strike should be ordered in their trade, and to give them employment so long as there is anything for them to do, and promises also to discharge at once those who attempt to frighten their fellow workmen into joining trade societies, and to prosecute conspiracies to the extent of the law. We trust that this promise will be carried out to the letter. Powerful as are the labor unions, there is no doubt that thousands of their best members are held in them simply by the fear, which is only too well founded, that by leaving them, or showing any insubordination, they would not only cut themselves off from employment, but would expose themselves and their families to bodily injury. If the masters really wish to make their men independent, and to guard themselves and their business in future against the arrogant interference of walking delegates, they must make up their minds to exert themselves. The promise of protection against the vengeance of a labor union is one thing, but the reality is something much more difficult, and if protection is to be undertaken at all, it must be thorough. We hope that there may be no occasion, during the year of experiment, for the Boston builders to assume the defence of non-union men, but if they wish to see, under their protection, the defections from the unions increase, and the ranks of independent workmen reinforced, they must watch over every hair of the head of the first bold men who dare to defy the trade organizations. They may be certain that the wives, at least, of most of the men never forget the terrible history of the great strikes; that they picture to themselves constantly the brutal and cowardly assaults, the wounds, and the violent deaths, which have followed revolt against the unions, and the sight of one bruised and bleeding "scab" will do more in a day to strengthen the labor organizations than all the promises of the masters can undo in a year, and nothing but the anticipation of speedy and easy success will tempt the prudent men to try to break the bonds which now hold them so firmly.

THAT the master-builders, if they will really try to encourage and defend liberty of individual action among their men, will have the sympathy and encouragement of the community, is evident, as well from what has already occurred as from the voluntary expressions of the persons invited to the Boston meeting who assured them, as we are told, that the insertion of a clause in all building contracts, relieving the contractor of all claims for forfeiture or demurrage on account of delays through strikes, "would be cheerfully granted." We believe that this is true, and that most people would willingly submit to the inconvenience of binding themselves, according to the form now common in England, not to demand damages for delay, "in case of combination of workmen, or strikes, or lock-out affecting any of the building trades," for the sake of helping in a struggle against tyranny; but if the public is to put in the hands of the builders this powerful weapon, which enables them to defy all attempts of the unions to dictate terms to

them, it will expect them, in return, to act promptly in endeavoring to avert or settle as speedily as possible all labor quarrels.

THE fixing of the day for the dedication of the great statue of Liberty ends the long period of uncertainty and anxiety which has elapsed since the first announcement of the gift from the people of France to the people of the United States. On the twenty-eighth of October, if nothing should prevent, the figure will be unveiled in the presence of representatives of both countries. Just what the ceremonies of unveiling will consist of no one seems to know, but we may assume that there will be speeches in English and French, both, probably very good of their kind, the French being quite equal to the Americans in the art of saying agreeable things at great length about nothing in particular. In this case, indeed, there will be more to say than usual. Perhaps the history of the battle of Yorktown and the services of M. de Lafayette is sufficiently well known in New York to need no very elaborate repetition, but there is a great deal in the present relation of France and the United States, and still more in the generous appreciation of nearly everything American which it is now fashionable to show in France, which all Americans would be pleased and proud to hear of, and we are sure that if some American who is familiar with the subject would take the trouble to describe to his fellow-countrymen the great works of peace which the French have accomplished since M. Bartholdi made his first model of the great statue, the remodelling of the school-system, the reconcilement of employers and employed, the improvement of agriculture and manufactures, and the restoration of the public finances, he would elicit, in return, an expression of admiration and respect, which would please the representatives of France as much as their appreciation of our good qualities gratifies us. Such opportunities for the increase of international courtesy and regard as the dedication ceremonies will offer are rare, and we trust that the occasion will be made the most of. On this side of the wide Atlantic we are too much disposed to forget that the whole world looks to the three great free nations, France, England, and the United States of America, to show what can be done by people acting for and governing themselves. We have been so long accustomed to laugh at the doleful predictions which have, for a century, been made about our own future that we care little for the troubles which beset the path of our two rivals, and even, perhaps, enjoy the anxiety which they occasion among those who have to deal with them; yet their difficulties, sooner or later, become ours also, and we can do nothing more effectual for our own advance in the long road which leads to universal liberty and happiness than to cultivate close relations with the two nations which, of all the great ones, care most and do most for the same objects as those which we ourselves hold dearest.

WE are sorry to say that the statistics in regard to the consumption of alcoholic liquors, which are put forth, no doubt, with the best intentions in temperance oratory, occasionally bear the mark of having been at least insufficiently criticised, if not invented on the spot, and it is something of a satisfaction to find, as we frequently do in French journals, figures given without any attempt to produce an effect, moral or otherwise, upon the reader. According to some of these, the greatest consumers of strong liquors in the world are the Danes, who drink, on an average, nearly twelve quarts of absolute alcohol per head every year. Next to them come the inhabitants of North Germany, who annually imbibe nearly nine and one-half quarts apiece; and the Russians follow, with something more than seven and one-half quarts. Austria and Baden are a little more temperate than Russia; and Belgium is considerably more so than these; while the Dutch, who have the reputation of being inordinately fond of "*wijnen en sterke dranken*," really consume, on an average, no more than the French, and little more than half as much as the North Germans. The Swedes are somewhat less bibulous than the Dutch, and the Norwegians are more temperate still, while the people of Bavaria and Wurtemburg, the chosen country of beer, consume less than four quarts of alcohol per annum; their brethren of North Germany thus surpassing them in thirst for stimulants nearly in the proportion of three to one. Notwithstanding the opinion of Cardinal Newman, that intemperance is the national vice of England, the English absorb annually only three quarts of alcohol per head, which is about one-fourth the Danish allowance, and less than one-third that of North Germany. The United States is nine per cent more temperate than England, and Italy is the most given to cold water of all civilized nations, the yearly consumption of alcohol being but one quart per head.

THE New York Arcade Railroad, according to the *Mail and Express*, is "beginning to show its teeth," not, it would seem, without some reason. For an indefinite period a certain number of owners of property on Broadway have been opposing the railroad in the courts, averring that the annual loss of rentals, if the road is built, will be six and one-half million dollars, the loss to the city in taxes one million dollars, while the value of the property "totally lost and destroyed" during the progress of the work will be thirty-seven million dollars. Just how these estimates are made up has never been quite clear, and the promoters of the road, probably finding, as most people do, that an imaginary enemy is harder to fight with than a real one, have just filed a petition to have the complaint of their opponents amended by striking out some of the vague assertions, such, for instance, as the allegation that "business will be destroyed on the line of the railroad," and by giving definite particulars as to the vaults which will be interfered with by the tunnel, the kind and degree of damage, if any, which will be occasioned to particular parties, and the nature of the "many other losses, inconveniences and damages" which are expected to fall upon various persons whose names are not given. The counsel for the opponents of the railway, according to the account, are "confident of defeating the motion," which they regard as a move "to free the bill for its incorporation of all incumbrances," and if they succeed in doing so, as there is no limit to the manufacture of statistics of the kind they presented, the construction of the road may be put off until the next century. On its face, the demand of the Arcade Company does not, to the impartial observer, appear unreasonable. The fact is that the account presented by the Broadway property-owners of the host of damages and dangers which would attend the building of the railway has always borne a considerable resemblance to the panic-stricken tale of the boy celebrated in history, who rushed into the house and told his papa that he had just seen a thousand cats on the front piazza. We all remember that when his parent asked for a bill of particulars of the animals, it turned out that the family kitten and another one were all that could be positively distinguished, and if the Arcade managers can succeed by similar questioning in reducing in the same proportion the thirty-seven million dollars of damages which they are accused of desiring to bring upon the property-owners, the public will not be sorry, in the interest of truth, to see the process applied.

ACCORDING to the *Revue Industrielle*, the American invention of paper wheels for railway cars seems likely to be eclipsed by the Russian invention of paper rails, which have been put into actual use, and have been found to be as durable as those of steel, at one-third the cost. Not only in expense of manufacture, but in cost of transportation and laying, the paper rails are far more economical than metal ones, and, as they can be made longer, and laid with fewer joints, they subject the cars and locomotives which run over them to less wear. It would seem that a rail of such a material must be inevitably crushed by the weight of an engine, or torn to pieces by the rolling of a train over it, but it is found by experiment that the tensile strength of a bar made of slips of paper simply glued together, without compressing, is about four-fifths of that of an iron bar of the same size, and there is less difference than one would suppose between the resistance of paper to crushing and that of iron. It is found, however, that there is much more adhesion between paper rails and engine wheels than when both are made of metal, so that it is not necessary to load the engine to prevent the driving wheels from slipping, and the wear which comes upon the rails is only that of the rolling of the wheels, which is comparatively slight. Whether the compressed paper would resist deterioration from other causes remains to be seen. In the paper wheels the fibrous portion is pretty well protected from the influence of the weather, but rails could not be protected, and the reduction of a portion of a track, by a local inundation, to its original pulp, would be a serious matter for the passengers in the next train that attempted to pass over it.

ANCIENT AND MODERN LIGHT-HOUSES.[1] — IV.



THE WATCH-TOWER OF KOAT-VEN

REVUE DES ARTS DECORATIFS

AS soon as the light-house was destroyed, the proprietors set themselves to work to find some one to rebuild it; fortunately their choice fell on John Smeaton, formerly a philosophical instrument maker, but later a mechanical engineer, and Fellow of the Royal Society, and it is to him we owe *the* famous Eddystone Light-House. He went to work methodically, and examined with great care the work of his predecessors, rejecting the weak and retaining the strong points; he then argued the matter out logically. In the first place he concluded that the weight should be as great as possible, and the mass as small, and that the structure must be safe from fire; these conditions he filled by choosing stone as the material from which to build it, and by so shaping the tower as to give it a broad base and slender waist — as he called it — he states that this form was suggested to him from contemplating the trunk of an oak, which had withstood a storm which had prostrated its fellows. He at once saw that the tower would not be secure if built of squared stones, like an ordinary wall, but that the stones must be bonded together so as to form one solid mass; this was in principle, the same as Rudyerd adopted, but as the material used was different, the result had to be accomplished by different means.

A natural solution was to anchor the stones with iron bolts, but this idea was discarded as involving too great time and expense, and instead the original idea was invented of dovetailing the stones to the rock and to each other; in this way the lower courses would be riveted to the rock, and each of the upper ones be equivalent to one solid stone.

In addition, it was considered necessary to fasten the stones of each course more securely to each other so as to prevent all lateral motion among them, and also to fasten each course to the one below it. The first was accomplished by oak wedges; each stone had two grooves, cut from the top to the bottom of the course; these grooves were one inch wide and three broad; when the stone was accurately placed on its mortar-bed, and beaten down with a wooden maul, two wedges were placed in the groove, one point, the other head down; they were then driven home rather gently at first with a rammer; these wedges were three inches wide, one inch thick at the head, and three-eighths inch at the point. As the pressure of these wedges was lateral they solidified the course.

Each course was fastened to the one beneath with oak tree-nails, two one-and-one-fourth-inch holes were bored in the outer end of each stone at the yard; when they were placed and wedged, a hole one-and-one-eighth inch in diameter was bored in the stone beneath, and the tree-nail driven in, to insure its jamming tight in the lower hole, the lower end of the tree-nail was split and a wedge inserted, so that when it reached the bottom the wedge would expand it, and effectually tighten it, the top was then cut off flush with the top of the course, and two wedges at right angles to each other driven into it. All the outside joints were then carefully pointed, and the other joints filled with grout.

I have thus far described the general plan in considerable detail, but it would be tedious to recount all the devices used in bringing this structure to completion; for other information the reader is referred to the accompanying drawings. Every pains was taken that ingenuity could devise to make this tower so strong that the utmost power of the fiercest storm would have no effect upon it.

The light was first shown from the tower on the night of October 16, 1759. On August 5, 1756, the cutting of the rocks to receive the foundation was begun; from the time Rudyerd's light was destroyed by fire till the completion of Smeaton's tower was three years, ten months and sixteen days, the actual working time on the rock itself being one hundred and eleven days and ten hours. Notwithstanding the danger, difficulty and novelty of the undertaking it was completed without the loss of a single life, and scarcely with a serious accident. This was doubtless in a great measure due to the fact that Mr. Smeaton, the designer and builder superintended every part of the work himself, both on shore and at the rock, so that the workmen were never without his intelligent assistance.

When the gilt wall surmounting the lantern was brought from shore, he fastened it in its position with his own hands, standing on a scaffolding consisting of four boards nailed together in the shape of a square, and slipped over the top of the lantern, a workman standing on the opposite side of this precarious platform to balance Mr. Smeaton's weight.

I have been thus particular in the description of this tower, as it is the type of most all that have succeeded it on rocky sites similarly exposed; it was a magnificent conception, and so far as its inherent strength was concerned it might be standing until the present day.

The following inscriptions were engraved upon it. On the first stone of the foundation, 1757, over the entrance, 1758. Round the upper store-room upon the course immediately under the ceiling,

EXCEPT THE LORD BUILD THE HOUSE THEY LABOR IN VAIN THAT BUILD IT. Psalm cxxvii.

Over the south window, 1759; on the outward faces of the basement of the lantern,

⚹ . NE. (door) . SE . S. SW . W . NW.

Upon the last stone set, being that over the door of the lantern on the east side,

24th AUG. 1759.
LAUS DEO.

In 1877, Sir James Douglass, member of the Institution of Civil Engineers, explained to the Institution the necessity for substituting a new light-house for Smeaton's famous structure.

There were two reasons — the first was that though the existing structure was "in a fair state of efficiency, yet unfortunately the portion of the gneiss rock on which it is founded had been seriously shaken by the incessant heavy strokes on the tower, and the rock was considerably undermined at its base."

The second reason was that in stormy weather the waves rise considerably above the summit of the lantern, thus frequently eclipsing the light and altering its distinctive character.

The latter defect was of but little importance for a long time after the erection of this light-house, but of late years when the coast lights were so much multiplied, and in addition all vessels carried signal lights, which formerly were not required, it now became a matter of absolute necessity that every coast light should have a reliable distinctive character.

In 1877, the Trinity House (the Light-House Board of England) determined on the erection of a new light-house and directed their Engineer-in-chief to submit a design and estimate of cost including the removal of the upper part of Smeaton's tower, that portion above the solid work; this demolition being necessary for the security of the lower part.

The site selected for the new tower was on the reef S. S. E. from Smeaton's light-house, about one hundred and twenty feet distant.

There was no probability of the rock being undermined here, as there was no surrounding point of attack at a lower level; the main drawback was that the lower courses had to be laid below the lowest tides.

The estimate was $390,000, but as the lowest bid from firms experienced in sea-work was considerably above this sum, it was determined that the Engineer-in-chief should do the work without a contractor.

By reference to the plate it will be seen that the general outline of the tower above the foundation was a curve, but that the face of the foundation was vertical; this change was made because it was found that the tendency of the curvilinear outline was to elevate the centre of force of each wave-stroke on the structure.

Therefore a cylindrical base was adopted and was carried two and one-half feet higher than the highest tides; the difference in height to which heavy seas rise on the two structures is very marked — this cylindrical base has the further advantage of affording a convenient landing platform.

The stones of the various courses are so cut as to interlock into each other, and were also fastened together with bronze bolts; the shapes of the stones differ from Smeaton's, but the principle is the same.

The first landing was made on the 17th July, 1878, when the site was examined and staked off for the workmen.

The first work done was to build a central core of rough granite laid in Portland cement; this core or platform was raised ten feet above low tide, and was of the greatest use.

For a radius of ten feet eight inches from the centre of the core the rock was cut in benches and cleaned, to prepare it to receive the foundation: around this and six inches from where the foundation would come a strong coffer-dam was built of bricks and Roman cement, the rocks were carefully cleared of all sea-weed with picks, and where they projected above the surface of the water strong sulphuric acid was used — every available moment by day and night was utilized in building this dam — it was seven feet thick at the base and its maximum height was also seven feet; three radiating walls were formed in the dam, (1) for strengthening the dam, (2) for reducing to a minimum the quantity of water to be ejected at each tide before commencing work, and (3) for affording, as they frequently did, a lee dam for carrying on the work, when otherwise it would have been impossible to keep the whole area free from water.

While those portions of the dam which were two feet below low water were building, heavy bags of concrete were first deposited along the outside of the dam — occasionally a few courses of brick were carried away, but the dam never suffered any serious injury,

[1] Continued from page 144, No. 561.

In connection with the work the twin screw-tender *Hercules*, one of the two steam vessels employed in the construction of the Great and Little Basses Rock Light-Houses at Ceylon, was used here; she was fully equipped with all necessary machinery and was moored about thirty fathoms from the rock.

The water was removed from the dam by two three-inch rubber hose, canvas covered and internally wired; they extended from the tender to the rock and the pumps of the tender, together with buckets used by the men, could empty one section of the dam in fifteen minutes.

No blasting was allowed for fear of damaging the rock, so all the superfluous rock was removed by drills, jumpers, cleaving tools and picks; this entailed considerable labor as each *face*-stone was sunk one foot below the surrounding rock.

A hollow wrought-iron mast twenty-five feet long and sixteen inches in diameter was firmly fastened in the centre of the work; two jibs were attached to the mast, one for landing the stone from the tender, the other for setting the stone; the drawing shows how these operations were performed.

This is probably the first application of floating steam machinery to the actual erection of a structure at sea.

By June, 1879, the work was sufficiently advanced to lay the stones in the foundation courses and everything was ready for H. R. H., the Duke of Edinburgh, Master, accompanied by H. R. H., the Prince of Wales, Elder brother of the Trinity House, Hon. M. M. Inst. C. E., to lay the foundation stone on the twelfth of the month.

The weather proved so boisterous that the attempt had to be delayed until the nineteenth of August, when the sea being fairly smooth the Royal party landed.

Prior to their arrival the dam had been pumped out and the stone, weighing three and one-fourth tons landed.

A bottle containing a parchment-scroll with full details of the work having been placed in a cavity under the bed of the stone, and the cement bed properly prepared, the stone was lowered and adjusted in position by the Master of the Trinity House, assisted by the Prince of Wales. The stone was then declared "well and truly laid" by his Royal Highness the Master.

Fair progress on the work continued during the working season of 1879–81, so that on the first of June, 1881, the Duke of Edinburgh landed on the rock and placed the last stone of the tower.

The interior fittings were carried to rapid completion, and early in the following year a temporary light was shown. In the meantime the new optical apparatus was installed, and on the eighteenth of May the Duke of Edinburgh completed the work by lighting the lamps and formally opening the light-house.

It takes a good deal of formality to get a light-house fairly underway in England.

The structure was completed within four years from the time it was commenced, and one year under the time estimated.

To give an idea of the force of the waves, a cannon six feet long and three inches bore, weighing ten cwt. was found at the base of the tower in the winter of 1881. It is supposed that it was one of those carried by the *Winchelsea*, whose wreck has been mentioned.

The Town Council and inhabitants of Plymouth were very desirous that that portion of Smeaton's tower which was to be taken down should be saved and reërected on Plymouth Hoe in place of the sea-mark established by the Trinity House. The Trinity House had no funds available for the purpose, but they delivered to the authorities at Plymouth, at the actual cost for labor, the lantern and four rooms of the tower; these were erected by public subscription on a granite base corresponding to the lower portion of Smeaton's tower, commemorative of one of the most successful, useful and instructive works ever accomplished in civil engineering.

The whole work was accomplished without the loss of life or limb to any person employed. The cost was $296,275, being $93,725, under the estimate.

This completes the history of the four light-houses on the Eddystone Rocks.

Relative Strength of Wet and Dry Timber. — In reply to a statement by the *American Miller*, that "wet timber is not as strong as dry, in some cases it has not half the strength of dry," a correspondent of that paper writes as follows: "In September, 1876, the Lanesboro mills, Lanesboro, Minn., burned, and that fall we rebuilt them and began making flour the next March. We used sawed pine (taken out of the Mississippi River), for joists 3" x 12", 12' long, and sized them, laying them on top of the girders, to get their full strength, and then used ⅞-match flooring. The joists were placed 12 inches from centre to centre, leaving 9 inches between them. In the fall of 1877 we piled wheat on the floor 26 feet deep in the bins, and the joists, yet wet and green, only sagged a trifle, and carried the immense weight safely. Two years later the same joists were dry, from the heat of our very large stove. We loaded the floor with 24 feet of wheat, and six joists broke off nearly square in the middle, and others were cracked. In the first instance the bins held 360 tons of wheat while the joists under them were green. When the joists were dry 300 tons or less broke several of them. This shows that green pine is stronger than dry pine, as the wood becomes brash or brittle by drying, and is not as strong as when green. This is caused by the sap drying and leaving only solid matter in the capillary tubes, and they cannot move one on another, while if the timber is green the tubes are full of water, and can bend or move one on another. I know of but two kinds of wood that are stronger dry than green, and they are maple and white oak."

ART IN ALSACE AND LORRAINE.[1] — II.



LABOR. E. DELAPLANCHE. SCULPTOR.

REVUE DES ARTS DECORATIFS.

Early Renaissance architecture has left no relics in Alsace which may be compared with those magnificent châteaux which were the chief boast of the age in France; but the various cities of the province are rich in less ambitious works — town-halls and private dwellings. The graphic arts began vigorously to develop in the fifteenth century, and among local names which are reckoned to-day as some of the most notable of their epoch in Europe, I may cite Martin Schongauer, who so potently influenced Dürer, and Hans Baldung Grün, who, coming later than Dürer, carried on the same artistic phase.

Strasburg plays an important part in the history of printing and book-making; Gruninger being the most famous of her sons in this department, which then was an art as truly as those which now are more properly so-called. Wood-engraving also flourished in the province, and Estienne de Laulne, who was engraver and goldsmith at once, is familiar to us through that little cut of his representing the interior of an enameller's workshop, which has so frequently been reproduced in modern times. Dietterlin, who was born at Strasburg in 1541, was an architect and an ornamental draughtsman of great repute; collaborated in the erection of Heidelberg Castle, and has left an immense book of so-called architectural designs, which are the most extravagant and fantastic and unrealizable things one could well imagine, but not without a sort of pictorial attractiveness, by reason of the marvellous though wild inventiveness they show, and the clever and effective way in which they are engraved. In despite of M. Ménard's theories they are far more German than French in accent.

The sixteenth and seventeenth centuries, indeed, showed in Alsace a very German spirit in every branch of art — a fact which is exemplified, of course, by the mere citation of such names as Schongauer and Baldung Grün. But with the eighteenth century a French phase begins. Loutherbourg, the painter (very famous in his day) of animals and picturesque rural scenes and architectural decorations, has his place in the chronicle of French painting, and was regarded as a French artist when he crossed the channel to decorate Drury Lane Theatre. The other Alsatian artists of the century have names which sound now German, now French; but in their work are also thoroughly Gallic. One of them was Guérin, famous in Paris as a miniaturist, and another was Heim, who was very conspicuous there during the early years of this century, but is now remembered chiefly by his series of clever portrait-sketches representing the members of the Institute.

All the contemporary artists of Alsace, M. Ménard claims, without a single exception, as children of France; expressing his surprise, however, that under the circumstances such should be the case. A less partial eye will find nothing to surprise them in the list. for it will find that all its names are *not* French in spirit. The greatest of them, in truth, we may accord to the Gallic school — Bartholdi and Gustav Doré and Henner, for example. But Brion, wherever he may have learned or practised his art, certainly seems Teutonic of soul, as do Jundt and Lix and Pabst — all *genre* painters of the school which believes that elaborate is synonymous with good technique, and often falls into sentimentality in its search for sentiment. Steinheil, on the other hand, I should be inclined to call French again—alike in his *genre* paintings and in his designs for stained-glass, conspicuous among which last are the reconstructed parts of the windows of the Sainte-Chapelle. The well-known Kierstein family of goldsmiths were Alsatians, and an Alsatian is the porcelain-maker Deck.

Passing now to the sister province, we learn that in the Middle Ages its art was much less important than that of Alsace. The great epoch of Lorraine began with the dawning of the sixteenth century, and the ducal palace at Nancy is the most important monument of the age. The most interesting feature which still survives (much of the palace having been destroyed) is the great door executed by Mansuy Gauvin, in the transitional style. Another interesting building in Nancy is the Hôtel Lunati, with a richly carved

[1] *L'Art en Alsace et Lorraine.* Par René Ménard. Paris: Librairie de *L'Art;* Charles Delegrave. Continued from page 134, No. 560.

and arcaded front, built in the early years of the seventeenth century. Both these works and also an elaborate street-well, pictured in the book before us, seem to me to show very distinctly the signet of the German rather than of the French Renaissance.

The greatest local sculptor of the Renaissance — Ligier Richier — belongs, on the other hand, to France, though even his works are not free from a Teutonic flavor. Specimens of his work may be seen in the Louvre, but his most important creation is in the town of Saint-Mihiel — the sepulchre of the saint of the same name in the Church of St. Stephen. It represents an entombment, and is composed of thirteen figures, larger than life, cut in very high relief from a stone which very closely resembles marble. The extremely skilful composition, and the noble, if somewhat "tormented" flow of the draperies show the influence of the Renaissance, though the general feeling speaks of the indigenous art of an earlier day, and the architectural details of the background are Gothic. Technically speaking, the work must be very remarkable (it is reproduced in a beautiful etching in our volume), and its charm of sentiment is also so great that I wonder it is not more generally included among the greatest masterpieces of the period. The "Judgment of Daniel," which is attributed to the same hand in the catalogue of the Louvre, is much more classic in effect, and shows architectural details of a rather heavy Renaissance type. It looks so much later than the sepulchre, that one would hardly guess them to have had a common creator; but, as is well known, the artists of that time often radically changed their manner between the earlier and the later years of their activity. So strong is the Northern accent of both the works, however, that one does not put much faith in the story that Richier studied in Italy — even, it is popularly said, under Michael Angelo.

I have already spoken of Mansuy Gauvin as the architect of the door of the ducal palace at Nancy; but in ancient documents he is spoken of as a "*menuisier*," so we may conclude that his contemporary fame rested chiefly upon sculptures in wood. Among other Lorrainers of celebrity I may note Woeriot, metal-worker and ornamental designer; and the Briots, who were among the most famous of the goldsmiths of the period. A ewer in the Cluny Museum at Paris is a very beautiful example of François Briot's art, executed in the style of Cellini a few years after his death, somewhere about 1580.

The painters of the seventeenth and eighteenth century in this province are altogether French, alike in name and art. Most famous among them are Callot and the prince of landscape painters, Claude. And the same is true of the modern school. Bastien-Lepage may head the list, and it includes such others as Feyen-Perrin, Français, Isabey, Jacquot, Laurent, Hector Leroux, Maréchal (who may be cited as the first pastellist to attempt landscape work, though this is by no means his only title to honor), Trayer and Yvon — truly an honorable showing for any one province, though I have repeated only the most conspicuous among local names.

Taking up now the topographical sections of the work, we find, of course, that much space is devoted to the city of Strasburg. Despite its checkered history, it has preserved, to an unwonted degree for so large and flourishing a town, its old-time aspect. Of the great cathedral, which shows the consecutive labors of four centuries, I need hardly speak in greater detail, for no existing monument is better known or more fully appreciated. Next in importance to this comes the Church of St. Thomas, now devoted to Protestant uses. It is in great part Romanesque, and one of its towers is claimed for the eleventh century. In this church is Pigalle's well-known monument to the Maréchal de Saxe, and — much more interesting from the true artistic standpoint—a chest-like tomb, said to be that of Bishop Adeloch, which is a most beautiful example of ninth-century sculpture. It is supported by grotesque animals; the sides are adorned with an arcade, the openings of which are filled by the most curious and diverse figures, and the inscription on the lid (which includes the date DCCCXXX) is disposed in a singularly decorative fashion.

The so-called "New Temple," which was destroyed in the German bombardment, was in reality a very ancient edifice. In 1824 a most curious "Dance of Death," encircling two walls of the church, was discovered beneath thick coats of whitewash, and the loss of the building is therefore doubly to be deplored. The church of St. William contains many interesting mediæval monuments, and among later works may be named the château (built 1728–1741, by the cardinal-prince Rohan, bishop of the town), the prefecture, the theatre, etc. The picture-gallery of the city, which held many fine Italian as well as northern and local works, was destroyed in the last war, together, as has already been noted, with the rich museum of antiquities, and the library, which contained one hundred and fifty thousand volumes and about sixteen hundred manuscripts, and had few superiors in Europe in the direction of precious illuminations and miniatures.

The town of Hagenau contains several interesting churches, one possessing considerable remains of early Romanesque date. The church of St. Peter and St. Paul, at Wissembourg, is of the thirteenth century, but preserves a tower from a more ancient time, and from here may be visited many of those commanding ruined châteaus which, standing amid the most picturesque scenery, are so frequent all through the province. Saverne is a very ancient town, already important in Roman days, and possesses a considerable museum of Roman and pre-Roman antiquities. Its parochial church shows portions dating from almost every mediæval epoch, while its episcopal palace is a huge and splendid work in the French fashion of the later eighteenth century. It was never completely furnished, owing to the breaking out of the Revolution, and is now used as a home for the widows of public functionaries. In the neighborhood of Saverne are the ruins of the two châteaux of Geroldseck, in one of which there is a well-preserved room with round-arched vaulting, supported by square pillars, which seems to be of the eleventh century.

The abbey-church of Marmoutier is one of the most important in the province. The interior is not earlier than the fourteenth century, but the fine façade and the three towers are Romanesque, of a simple and stern, but noble type. Our author attributes the façade to Drogon (already named as a natural son of Charlemagne), who was bishop of the town in 825; but in the illustration it does not appear to be so extremely early a work as this would imply. Not far from the town is the Abbey of Neuwiller, to which is attached the Church of St. Peter and St. Paul. Parts of it date from the twelfth century, and the chapel of St. Sebastian, which is attached to the choir, is of the Carlovingien period. It consists of two superimposed apartments, and in the lower, or crypt, is a baptismal tank large enough for the immersion of converts. The carvings of the upper chapel are of a rich Byzantine type. Another church at Neuwiller is also very early Romanesque; but the most charming Romanesque monument of the neighborhood is the church at Rosheim. It dates from the twelfth century, and in general composition, as well as in the design of its main features, has a very early and a very south-French accent; but its sculpture is so profuse and so beautiful, and the profiles of its bases and cornices are so pure and charming, that it is accorded by an architect of local birth but European authority— Boeswilwald — a quite exceptional place among the structures of its time and neighborhood. It is singularly free from later additions, the only pointed work which shows in the external view being in the upper stage of the octagonal central tower.

The finest ruin in Alsace is the Castle of Haut-Koenigsberg, near Schlestadt. It was built in the shape of a very long parallelogram, divided into three sections, the central one of which was devoted to domestic purposes, while the others formed the defensive works; and this, we are told, was the usual form of such castles in the province. Many portions are still in a fair state of preservation. Not far away is the Mount of St. Odile, which is very lofty and affords a magnificent outlook over innumerable hills crowned with ruins. On its plateau are the remains popularly called "the pagan walls." There apparently once existed here an enclosure measuring some ten thousand metres in circumference, and composed of rocks connected together by rude masonry of cyclopean aspect. And together with these relics of unknown antiquity are traces of Roman roads and isolated stones, like the menhirs and dolmens of Brittany. The mount takes its name from a famous saint who established herself here in the seventh century. The monastery (of course not of her date) still stands and is even to-day a favorite place of pilgrimage.

Ribeauvillé is a small town which preserves much antiquity of aspect. Several of its buildings are very interesting, and its little museum contains a number of beautiful Renaissance vases, which convincingly show the skill and taste of the local school of goldsmiths. The series which they represent was the gift of successive generations of the seigneurial family of Ribeaupierre. Unfortunately the mediæval examples have perished, and the most splendid cup of all — a huge sixteenth-century work measuring nearly a metre in height, and ornamented with many figures — is to-day in Munich. The grandfather of the present king of Bavaria claimed it, upon his succession, as a family heirloom, for he was of the blood of the Ribeaupierres.

All the towns I have thus far noted stand in the neighborhood of Strasburg, but the Alsatian city which is most important after Strasburg itself is Colmar. The architects of its cathedral have already been named. The greatest pictorial treasure of the town hangs within it — Martin Schongauer's famous "Virgin of the Roses," reproduced in M. Ménard's book in a charming etching by Greux. The town-hall is a somewhat simple but interesting early Renaissance or more properly transitional work. Its Gothic elements show none of the extravagance we often find in transitional work in Germany, but even our author cannot but remark that the close-set row of square-headed windows, divided only by pilaster-mullions in the upper story, has a German rather than a French aspect. Many charming Renaissance houses still survive in the narrow winding streets of Colmar, though their number is being diminished year by year. One, which dates from 1538, is the ancestral home of that Haussman family to which belonged the great "improver" of Paris. The house of the Knights of St. John is an early Renaissance work, much more French in expression than most of its neighbors. It shows a low, round-arched portal, and above, two superimposed arcades, also round-arched, opening into *loggias* and surmounted again by a classic balustrade. All these features are very plainly treated, but in upper arcade the supporting columns stand upon an open parapet of rich flamboyant design. The effect is very curious, and, though picturesque, rather "patchy." But what interests us most in the composition is the striking instance it gives of that similarity in general effect which often exists between early-Renaissance features and Romanesque. M. G. van Rensselaer.

ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

THE CYRUS W. FIELD BUILDING, BATTERY AND BROADWAY, NEW YORK, N. Y. MR. E. H. KENDALL, ARCHITECT, NEW YORK, N. Y.

[Gelatine print issued only with the Imperial editions.]

THE THEOLOGICAL SEMINARY, NEW YORK, N. Y. MR. C. C. HAIGHT, ARCHITECT, NEW YORK, N. Y.

[Gelatine Print, issued only with the Imperial Edition.]

WORK OF THE STUDENTS IN THE CLASS IN DECORATION AT THE MUSEUM OF FINE ARTS, BOSTON, MASS. INSTRUCTOR, MR. C. H. WALKER, ARCHITECT, BOSTON, MASS.

SMEATON'S LIGHT-HOUSE.

For description see article on "Ancient and Modern Light-houses."

A SCULPTOR'S STORY.



From L'Art.

There are very few people in Paris who do not traverse the Boulevards a great many times in every month, and as all passers-by are sure to gaze at the windows of the shops where bronzes are sold, it may be concluded that there are very few people in that city who are unacquainted with the figure of "François Villon," by M. François Etcheto, although they may not all have seen the original in the Square Monge. Villon or Corbeuil is a poet who has found devotees of late in England no less than in France, and his sincerity of utterance, however low may be the subjects, has an undoubted charm, especially if it is remembered that he was born four hundred and fifty years ago, when people were afraid to express their thoughts. But, apart from that, Villon is an important figure in French literature. The respectable Boileau, who was not disposed to be friendly to poets who were deficient in the moral sense, says that Villon was the first of the Frenchmen who practised poetry as an art:

> Villon sut le premier, dans ces siècles grossiers,
> Débrouiller l'art confus de nos vieux romanciers.

The life of the poet was more sad than any that Johnson related, unless we make an exception in the case of Richard Savage. Villon was an university scholar, but somehow his acquaintance with Aristotle and Averroes brought him no office. Like Jack Falstaff, he came to believe that thieving was his legitimate vocation. But, unlike the English knight, Villon came under the "rusty curb of old father antic the law." He was put to the torture, and was twice condemned to the gallows. Strange to say, the cold-blooded Louis XI always intervened in his favor, but no honest employment was provided for the poet. However, a priest was inspired with pity for Villon; he was carried off to the provinces, and there spent what was left of his life in peace and comfort.

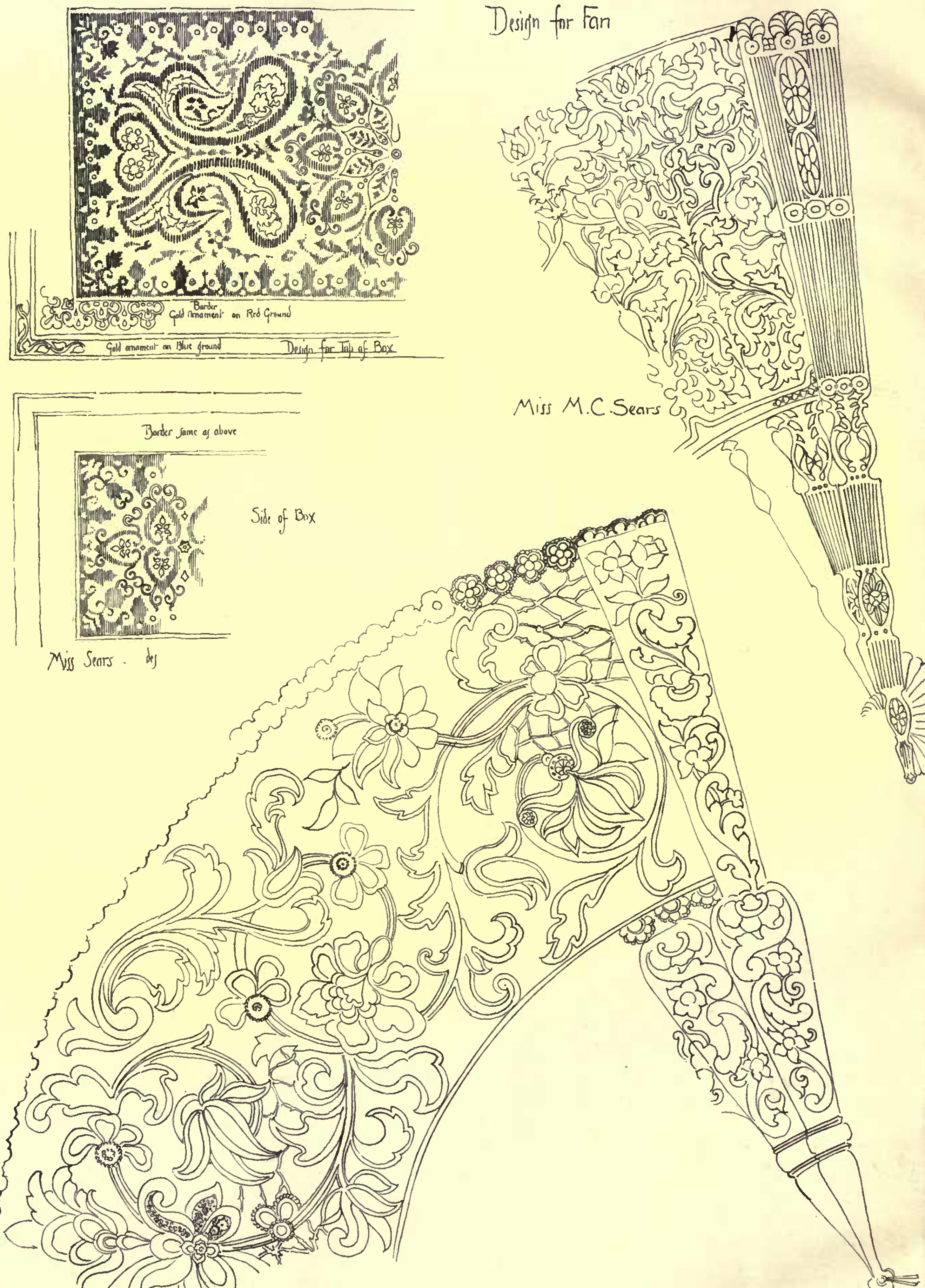
Villon was thus a poet for whom the gutters of Paris served instead of the Pierian spring, and as a thorough representative of the Quartier Latin it was only fair that his image should appear before the eyes of students of a later age. The statue that adorns the Square Monge is as characteristic as any piece of portraiture in the city. Villon becomes suggestive partly of the feathered Mercury and partly of the *gamin de Paris*. As he stands he inclines a little to the left side, for a perpendicular pose, however well suited to a mathematician or a politician, would hardly correspond with the mode of thought of so peculiar a moralist. We know that "every true man's apparel fits your thief," and a tailor would be sure to say that Villon never was measured for the habiliments he is made to wear. But the short overall answers well for the concealment of thievery of an obtrusive kind, and, moreover, the loose folds may be a protection against an occasional pass of a rapier. The lute at the feet suggests the minstrel. The matted locks reveal he is one that comfortable citizens would consider to be of a disreputable class, who has often slept in the open air for want of a roof, but the keen eyes and the sensitive lips denote a spirit who could see beyond the shows of things. For Villon was able to moralize with the best over the riddle of life, and the talk of Hamlet in the graveyard is marvellously like what we might expect from a man who had just been reading some of the verses of the scapegrace. Our English experience suggests the difficulty of making a statue of a poet. Burns in Dundee, Tom Moore in Dublin, the crowd in Poet's Corner, all testify in that way. Abroad there are also figures of poets that offend the eye. Indeed, in all Europe we doubt if one can be discovered which is as expressive as M. Etcheto's "Villon."

If, on seeing the statue, any one might ask about the sculptor, the information would not be readily obtained. Strange to say, this marvellous work is one of the two which are all that are forthcoming to represent the powers of so able an artist. The second is a figure of "Democritus," of which the marble copy was to be seen in this year's *Salon*. M. Etcheto is at present an invalid. The misery which sometimes awaits sculptors as well as poets was his lot, and it overcame a frame that was frail by nature. Thanks to the intervention of M. Paul Leroi (and it is not the first time his influence was exerted in behalf of unhappy artists), M. Etcheto was rescued before he was overwhelmed. He is now at Pau, and every one who loves art must wish that a man whose genius is unquestionable may shortly be restored, and be able to endow his country with noble works. In the "Villon" we see only the 'prentice hand of the sculptor, and from such a beginning we expect much. In the last number of *L'Art*, M. Paul Leroi modestly relates the story, keeping himself as much as possible in the background:

"When M. Etcheto exhibited his plaster models of the 'François Villon' and the 'Democritus' in the *Salons* of 1881 and 1883, I was," says M. Leroi, "very favorably impressed by them. M. Eugène Guillaume, and subsequently M. Ernest Barrias, the sculptor, expressed to me how deeply they sympathized with the sufferings endured by one who was a genius of the rarest class. Having admired the artist, I was eager to become acquainted with the man himself. I found M. Etcheto overcome with fever, and shivering near a handful of fire in a damp studio, that was close to the fortifications, and which became more dreary when one remembered that it was within a hundred yards of the elegant mansions of the painters in the Avenue de Villiers. He was without any commission, but in spite of his illness and misery he was modelling with a trembling hand a small figure of a woman, to which he imparted infinite distinction. I was heart-broken with what I saw. I promised to come again, and when I did I had the good fortune to be made the bearer of a commission for a reduction in marble of his "Villon," which was offered by an eminent amateur (the Baron Alphonse de Rothschild), who, having become a member of the Institut, signalized his election by a generous and delicate encouragement of the sculptor's art. Sculpture is to-day the most marked glory of French art, but its votaries are badly recompensed — as, indeed, they have rarely been otherwise.

"M. François Etcheto was enabled to remove to a more habitable studio in the Rue Aumont-Thiéville. Unfortunately for him, the change was too late. His weakness had increased, and it was no longer possible to have any illusion that it was to be of a short duration. He continued, however, to work without any abatement of fervor; this time it was on the reduction of the "Villon." I counselled him to take some repose, assuring him that nothing could be more contrary to the desire of the patron whom I represented than his struggle to execute the commission in spite of his illness, and by which he was aggravating the danger. My efforts were all in vain. Having accepted the price of his statue in advance, M. Etcheto felt that he was bound to uphold the dignity of his art by completing the work. When it was ready, then he could be free. He held to his resolve in spite of all my entreaties; but I could not help feeling respect for him, while I feared the consequences of his honorable conduct.

"I resolved to bring the case before a lady artist whose position in the great world is only employed in efforts to make people happy. Endowed with the highest intellectual gifts, her heart is as large as her intelligence, and this lady renders a service in a way that suggests the recipient instead of the donor of a benefit. I knew of some of the cases in which men of letters had been aided by her kindness, and how, also, artists had reason to bless their 'bonne camarade.' I had, therefore, no misgiving about the result of my appeal. I was



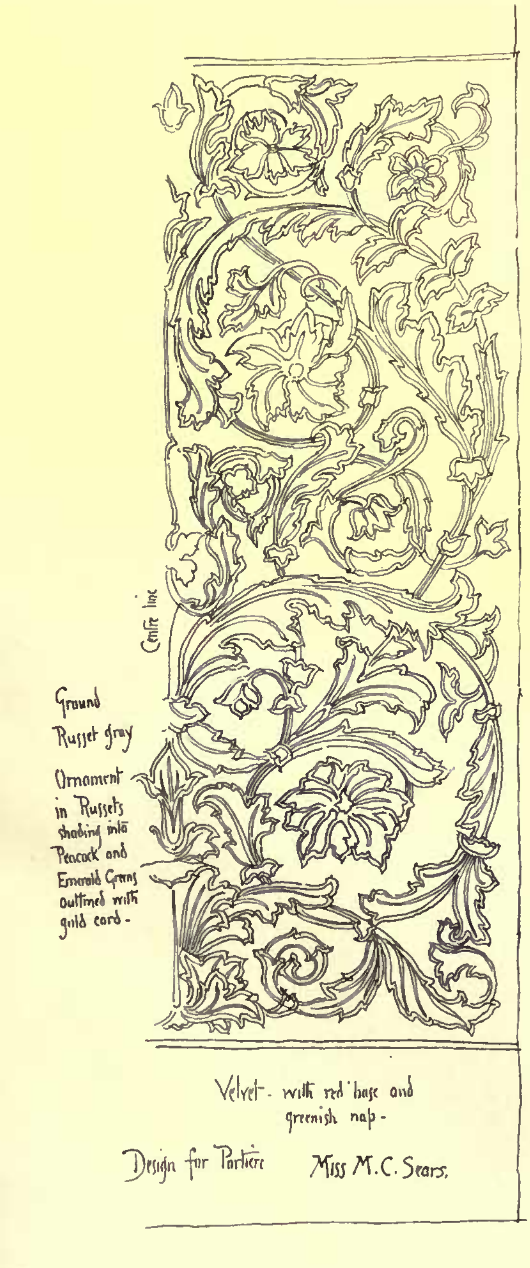
WORK OF THE STUDENTS OF THE CLASS OF DECORATION
AT THE MUSEUM OF FINE ARTS, BOSTON, MASS.

C. HOWARD WALKER, In

& Co.

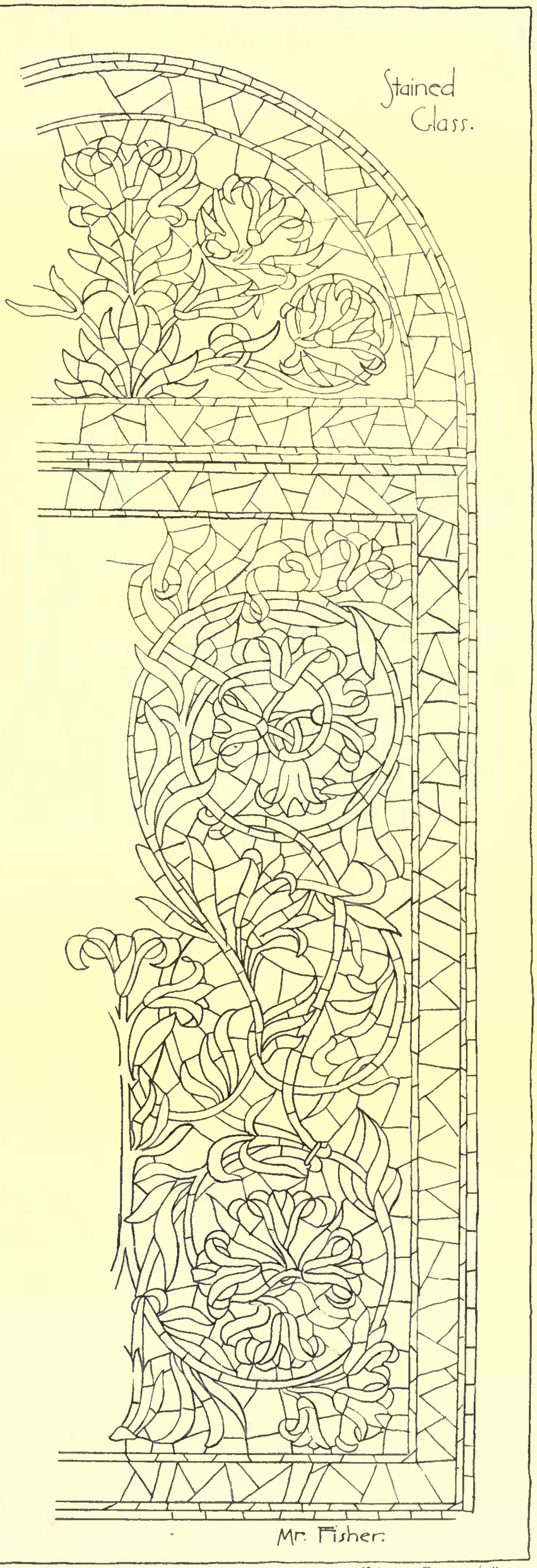


e. quarter of Design for Sofa Cushion - Miss. C. M. Pratt.



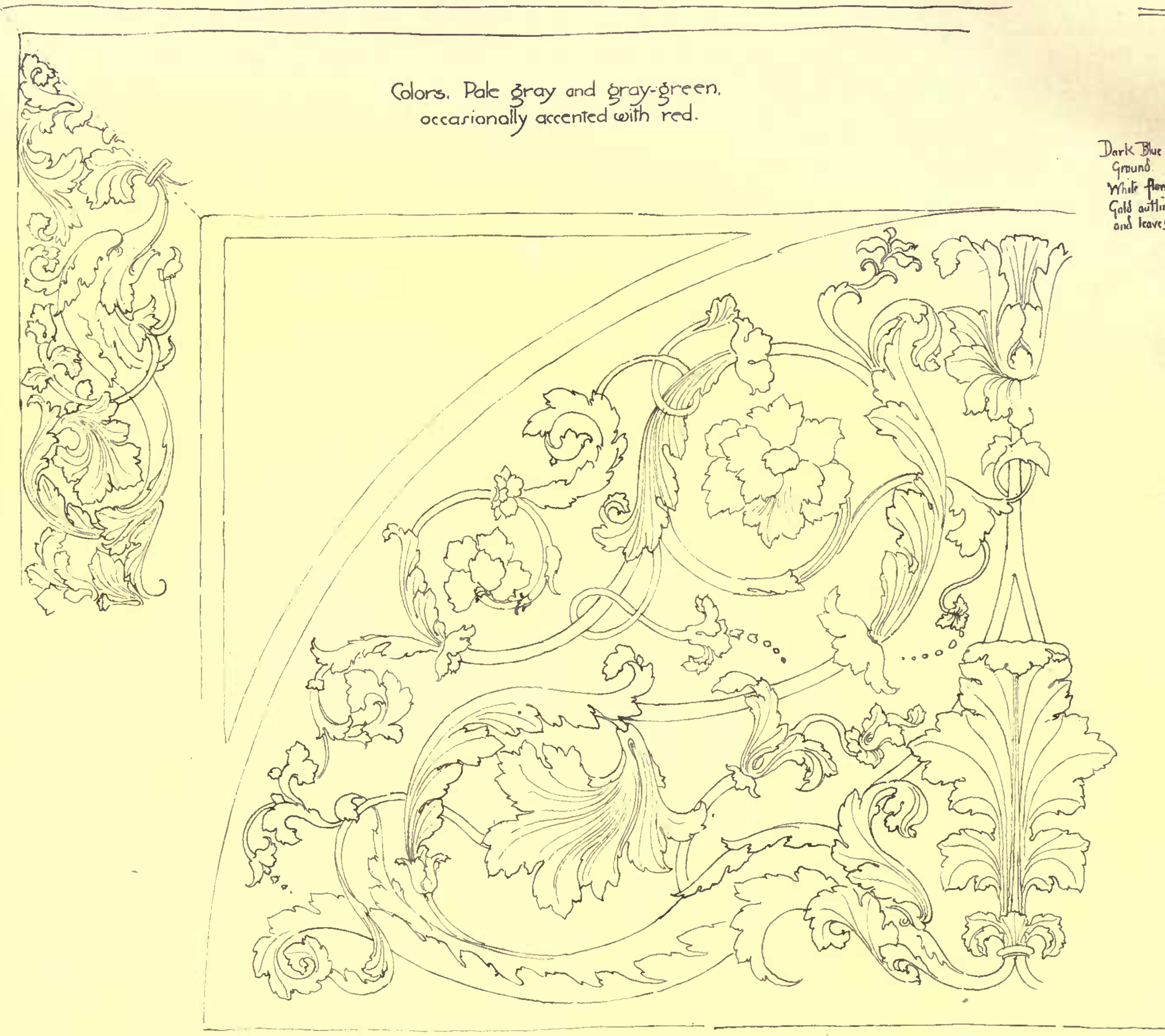
Velvet - with red base and greenish nap -

Design for Portière Miss M. C. Sears.



Mr. Fisher.

Heliotype Printing Co. Boston



Design for Panel and Border.

Miss C Goldthwaite.



Design for Tile
for Wall Surface only

Pattern slightly raised
from ground –

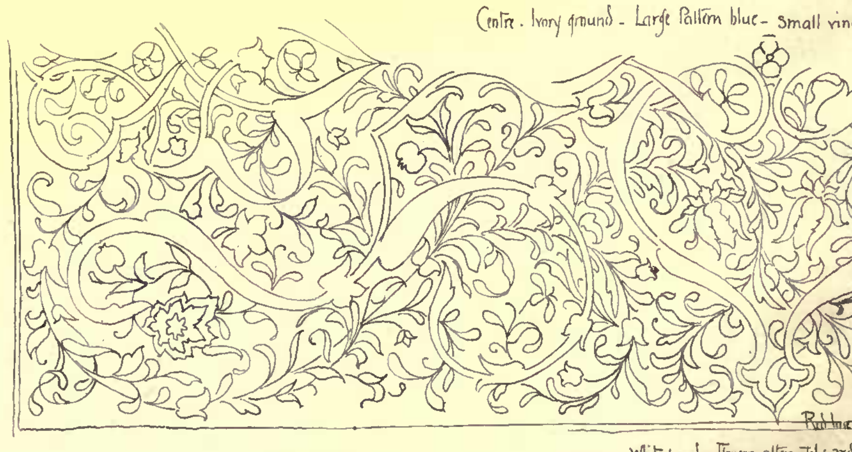
Ground Deep Blue-green
Glaze – growing greener
towards centre

Ornament in dull russets
and reds –



Miss M. C. Sears

Centre. Ivory ground – Large Pattern blue – small vines



White ground – Flowers alternately red

Design for Rug –

Miss C. Gold

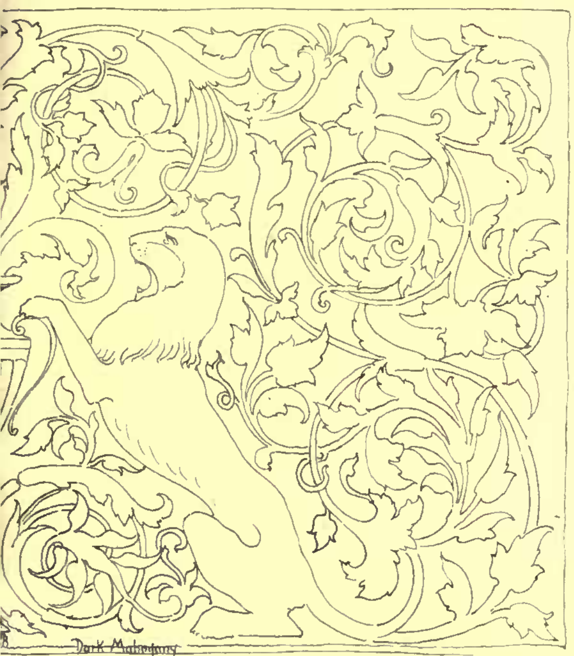
WORK OF THE STUDENTS OF THE CLASS OF DECORAT

AT THE MUSEUM OF FINE ARTS, BOSTON

Knor & Co.

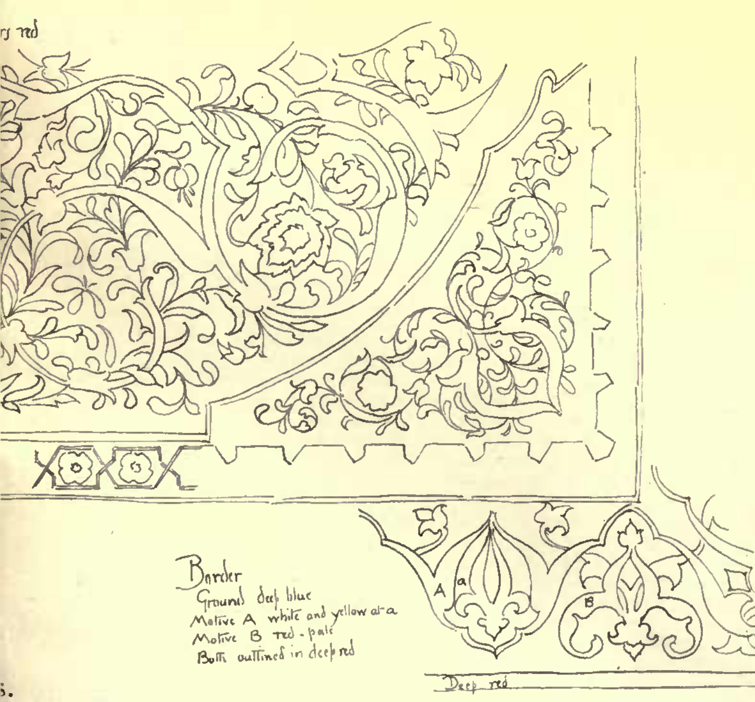


Howe



Design for Inlay

Miss C. Goldthwaite.





Design for Rug

Miss M. C. Sears.

Blue Border

C. Howard Walker, Instructor.

hardly allowed time to state the circumstances before I was asked to return to the Rue Aumont-Thiéville and to order the invalid to depart forthwith to Pau, and there to entrust himself to the intelligent care of Dr. Meunier.

"The friends of M. Etcheto will be glad to learn that at Pau his health improves from day to day. Before leaving I asked him for a few autobiographical notes, and I have received the following in a letter dated November 16, 1885:

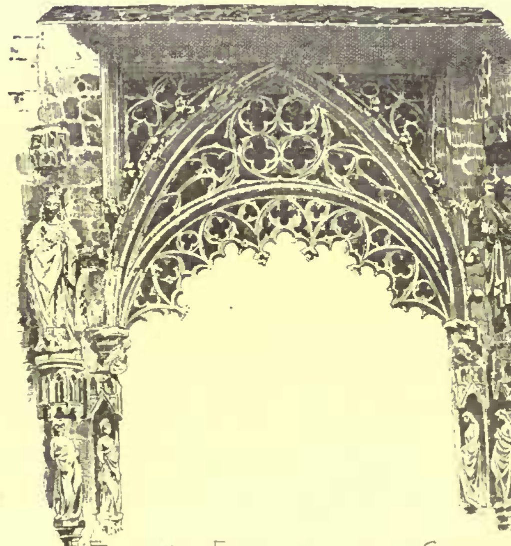
"'I was born of French parents in Madrid in 1853. I have gone through five years of military service. While stationed in Paris I was more or less able to attend the classes of the Ecole des Beaux-Arts. I belonged to the Atelier Jouffroy. It often happened that M. Jouffroy (whom I did not recognize as the professor) came beside me to give his advice to other students. I was entirely ignored. This conduct irritated me against him, and when I exhibited my "Villon" I did not describe myself as his pupil, but as "Etcheto, élève de l'Ecole Nationale des Beaux-Arts de Paris." That was my way of protesting. Although both M. Dubois and M. Falguière inspired me with admiration, I feared to be troublesome, and therefore have had little to do with them. I was in this way deprived of advice which might have made something of me. I know my deficiencies and must follow my unambitious career. When I compare myself with some of my friends who have vigorous constitutions, a supreme enthusiasm, and an undaunted courage, I often doubt if I am born to be a sculptor. They can produce works unceasingly, while I have made two statues. I have executed only a single bust that was commanded by the State. It is mediocre in character, for it was taken from an engraving, and I am not eager to undertake another work under such unsatisfactory conditions. In short, I am not an able man. I am deficient in knowledge, and am a slow workman. I forget myself in a contemplation of my model, and don't advance. In this way my works have cost me dearly. I am more disposed to study, or rather to produce no more than studies when treating a subject, and I make and destroy with the same outlay of nervous force, which becomes a very great fatigue. You ask how was my vocation revealed to me? I believe it was while trying to make my "Villon," for before that time I was unable to finish a single study in the atelier, and one of my comrades, named Dampt, therefore used to call me "le lâcheur." I must say, however, that he has shown himself to be a sincere friend, and I heartily admire him. It was while alone in my atelier, in the Passage Dulac, standing before a work of which I could not foresee all the difficulties, and with scanty resources at my disposition, that I drank, once for all, the bitter cup, and if I was brought to comprehend how hard was the sculptor's life, I was also taught to love it as the greatest of the arts.

"'I fear I am unable to say anything interesting concerning myself. I have an afflicting remembrance of the deception that I felt in returning to the ateliers of the Ecole des Beaux-Arts. I was full of faith in my art. I expected to enter in a sanctuary, and, instead, I became a witness to all the stupidities of which ill-educated men can be capable. I have been harmed in this environment. I have lost my time and my best illusions. But what was to become of me if I remained in Paris and did not accept the offer of my benefactress? It gives me great pleasure to think sometimes that I may be able to do something to satisfy her intention. Do not forbid me, for I know the extent of my powers. Gratitude may double them, and then I shall have the happiness to produce something that may be called good sculpture.'

"This is no idle dream, for, if M. Etcheto recovers his health entirely, we may expect some additions to the two remarkable creations which have gained him so high a place among French artists. We have a right to expect much from a man who is described by one of the most clear-sighted of his friends as having the most superb artistic visions, which he timidly recounts, as if his enthusiasm were a failing which was sure to be ridiculed, and which are followed by a state of mental depression that is almost incredible. But the power that is exemplified in the 'Villon' and 'Democritus' leaves a hope that the sculptor will surmount all despondency, and reveal his strength in realizing one of his dreams, which is the model of a woman palpitating with life. He will then be able to express the treasures of poetry which vibrate in him, and which for a time have to be suppressed."—*The Architect.*

A Tunnel from Sweden to Denmark. — Mr. Alexandre de Rothe, an engineer who has been working at Panama under M. de Lesseps, has presented to the governments of Denmark and Sweden a project for a submarine railway tunnel under the sound between Copenhagen and Malmo. The tunnel is to have a total length of twelve kilometers — three between Ameger and the small island Saltholmen, under the Straight Drogden, and nine between Saltholmen and Sweden. The ground to be worked much resembles that in the channel between England and France, and is said to offer no difficulty to the execution of the work. The cost of the construction is calculated to amount to 30,000,000 francs, or £1,200,000. The Swedish government takes a great interest in the plan, while the Danish at present is keeping somewhat back. Mr. de Rothe entertains sanguine hopes of a successful result of the negotiations. The tunnel would be of the greatest importance for the future commercial connection between Sweden-Norway, and later on of Russia and the whole continent, as laden railway wagons could then run from the north of Norway, Sweden, or Finland down to the south of Italy.— *Copenhagen Correspondence London Standard.*

ON WORKS OF ART FROM THE POINT OF VIEW OF OTHERS THAN ARTISTS.



FROM THE ENTRANCE OF A CHURCH AT NUREMBERG

REVUE DES ARTS DECORATIFS

AMONG other characteristics of encouraging progress within the experience of the present generation, very noteworthy is a movement for the establishment not only of metropolitan, but of provincial and municipal, museums and galleries of fine art. The public spirit no less than the personal pride of the wealthy, has seconded the popular interest and enthusiasm, which have allowed the devotion of considerable national funds to such purposes. The promoters of these institutions have been laudably anxious to secure a standard of high, of lofty excellence, in the works which are assembled; it has also been an object to embrace the excellence of a diversity of arts and a variety of styles.

Opportunities of acquisition have not been wanting; the vicissitudes of states and governments and of private families also, continue to supply them with considerable frequency. Collections made by the enthusiasm of ancestral dilettanti tend to dispersion under the influence of necessity, indifference, change of taste or prudence. Rents decline, families multiply, investments are tempting, a plunge on the turf is disastrous, and libraries or sculpture galleries unused and unappreciated, except for the pride of possession, give forth their treasures "to wander heaven-directed" to those who can truly understand and, often, better value them. Even the sanctity which was supposed to hedge round heirlooms has proved no safeguard against reasonable legislation; and the sound of Mr. Manson's hammer is heard in noble houses, as impartially as, Horace is ever unpleasantly fond of telling us, the knock of the foot of pallid Mors beats the doors alike of palaces and hovels.

That the boon of accessible collections of masterworks in art should be valued by the ever-increasing students of art, is to be expected and natural; and how they may make the best use of the boon is a subject of great interest, a subject however, which under the interest of another shall here be left aside. The question may be naturally and earnestly asked by a still more numerous class, how shall we who are not, and are not likely or anxious to be, artists either professionally or as amateurs, not derive all the enjoyment and advantage from these exhibitions which it was the hope and the aim of the artists themselves to confer?

Certain it is that many are capable of deriving the truest and purest pleasure from art, who when first they are confronted with it, and even especially with its more renowned examples, find themselves strangely indifferent if not repugnant, bewildered if not puzzled. But in these days of criticism, they are not likely to be in want of advice. The professional critic is as near their elbow as the proverbial tempter of idleness. His assumption of authority is supreme, and his promises of instruction are as extensive and mellifluous as those which the Ithacan resisted with such difficulty:

Hither away, highly-landed Ulysses, great pride of Achaians!
Stay the course of your ship that you may list to our voices,
For never as yet has one in his sable ship passed by here,
Before having heard from these lips of ours the mellifluous voices;
But away he has gone after having delight and with knowledge extended.
For in truth we know all things, whatever it was that in spacious Troia
Argeians and Trojans with travail endured by the gods' appointment
And all things whatever we know that arise upon earth prolific.
[Literally and lineally translated.] — *Odyssey* xii, 184.

If the disciple gives in to the voice of the charmer, he will be apt to find himself presently taken in hand to some purpose, and fitted with a pair of blinkers which will allow him to see nothing to the right or left, and not too much in front of him. "Bow down," he may perchance be told, "to Carpaccio, to Botticelli, to Tintoret, Titian, eschew Rembrandt, Rubens, Claude; allow but slight allowance and little time to selected works of Raphael and Michael Angelo as

compared with Dürer and Giotto; accept my superlatives both of enthusiasm and supercilious contempt; and if, as time goes on, I seem to have been feeding you with husks, be assured that the fault is in your own unhappy incapacities of ingestion and digestion."

It may well be a relief to turn to another guide of large sympathies and even intellectual scope. His interests in art are universal; he regards and values all masters and all schools; for can he not trace throughout, the subtle interchanges of an historical development? And widely as his survey extends, it penetrates no less deeply; there is a microcosm of art as well as a macrocosm. Within the range of a single school, nay, within the career of a single master, how many nuances of style may not be distinguished; what fine distinctions of manner before an acme is attained, and then how many more in the progress to decline. And he will as eagerly insist that the scope of historic view must not be confined to the studios, or even to social characteristics; he will read all contemporary history, all prognostications of revolutions in politics and morals, into or out of pictures, statues and poems. "All are but parts of one stupendous whole," and no part can be understood and appreciated to any good purpose, unless on a principle of comprehensive illustration.

These critics ever make it the most important point of all in the arrangement of an exhibition, that the pictures shall be arranged in chronological order; to this considerations of subjects and symmetry, or of interference by harsh contrast, and it is well if not also of appropriate lighting, must give way. Only thus we are told can be cultivated — and what, it is thought, can be more important — the faculty of deciding at a moment on the period of an artist's life and art to which a particular work is to be assigned, and of disserting upon the succession of his methods and evolution of his processes under reaction from his contemporaries. Gaps will occur in such sequences; but the critics may be trusted to bridge the intervals with theories that dispense with dependence on the vagaries of talent or infinite versatility of genius.

Not that there is not much in the study of art from this point of view that, when skilfully and soberly conducted, is not worthy of esteem. But it is work of specialists; in its nature it is subordinate to that study which will give true guidance to the recognition and appreciation of the beauty for which alone all true art exists. Let the specialists discuss such matters among themselves, and report results for the benefit of the general world, when they find themselves approaching to agreement. Usually they provide for those who are far beyond the earlier stage of novices but windy provender: "the hungry sheep look up and are not fed."

The general world for whose behoof public exhibitions are chiefly though not exclusively instituted, goes to fine art, and wisely, less to be instructed than delighted—it expects beauty not to lecture but to charm them; it assumes a frame of mind less prepared to understand than to enjoy.

Understanding, a measure of even special information and intellectual furniture generally, cannot be dispensed with. But what is requisite does not concern technicalities and antiquarianism, but chiefly what is indispensable to enable the spectator to apprehend the conditions on which the pure æsthetic enjoyment of the several works of art depends. And the spectator would fain be allowed to make up his mind upon one work of art at a time.

The most salient characteristic of a work of art may be an incident more or less complex, a simple action or a sentiment. These distinctions are exhaustive if liberally interpreted; but they are not to be pressed into too positive separation amongst themselves. "A Battle of the Amazons" by Rubens, a conversation piece by Terburg, a landscape of Claude or a portrait of a lady by Reynolds, may serve as exemplars. The interest of the portrait seems dependent on pure sentiment; but sentiment, which is a phase of passion, is the soul of interest in the most complicated incident, and every action, however simple, is so far forth itself an incident.

Still difference of degree constitutes a real difference. From the various and even vehement actions and passions represented in a cartoon of Raphael, it is in contrast with one of his Holy Families, in a group of a watching mother and sleeping infant. The term dramatic is not wholly inapplicable to a representation of a battle or a martyrdom, and to subjects including numerous figures in excited action as Hogarth's "Election," or "Marriage à la mode." The border of the class is touched by even landscapes in such an example as the Wilson's "Slaughter of the children of Niobe," and a storm by Nicolas Poussin.

But when the incident in a landscape is so tame as the "Embarkation of Queen Dido" by Claude, the subject can at most be called one of action. This category includes most of the great antique single statues, as the Diana of the Louvre in act to draw an arrow with a distinct intent; or Apollo who watches one which he has that instant discharged. The Moses of Michael Angelo exhibits an action which requires to be explained; there is a deciding motive in the groups of Raphael's Holy Families, different in every case; and in portraits the fact is often as positive, as when we discern by the bend of his cape that Leo X has only just withdrawn the lens from his eye with which he has been examining the illumination which lies before him. There is action in the portrait of Dr. Johnson bending shortsighted over his book, no less than in that of Sterne, which shows how the sudden movement inspired by a humorous thought has disturbed the symmetrical *sit* of the wig to the scandal of the robes of that very peculiar ecclesiastic.

But in portraits generally, sentiment pure and simple predominates spontaneously, because the air of the head — that old but most descriptive expression for the light involuntary poise — not pose — more characteristic than any gesture—is consequent on a prevailing tone of thought, on the momentary wave of feeling which defies detection and interpretation in words, and yet speaks a language which is universal. Sentiment may be considered to be superseded by the equivalent of action, when the portrait appeals to the spectator in a spirit which admits of interpretation, appeals to him with dignity or pertness, or refers us directly to the studio by an obvious consciousness of sitting or standing to be painted, or generally as attentive to something on the hither side of the canvas. The Duchess D'Arenberg by Vandyck, seems to say without reserve or affectation, "I am standing for my portrait, full dressed, dignified, gracious, well content with the world, and the painter and of course with myself; my child standing in front of me is also dressed for the occasion; it is not my fault if his attention wanders, and that he points at something out of the picture."

The appreciation of the proper excellence of a work of true art demands concentration of attention; by this alone can we penetrate to and be penetrated by the sense of the principle of its characteristic unity. We shall not attain to this if we are constantly being urged to look now at one on the right hand of it, and now at one on the left. We shall be in as inapt a state of mind either for reflection or enjoyment, if we are flinching every moment from the bayonet of a critic behind us, and threatened with the direst penalties of denunciative eloquence if we venture a hair's breadth from the lines of a judgment irrevocably fixed. Great are the distractions of a crowd of works in themselves; under this influence too many become content with a cursory glance and away: "Ah, yes, an effect of green," or "Ah, yes, a composition on the principle of the pyramid;" but upon these art and genius are thrown away.

The spirit of a work of art will of course not be evoked by simply staring at it; we must peruse, must converse with it. In subjects of simple as of complex action, we must put them to question as to what is going on, what is the movement about; and we must be familiar with a work of less definite sentiment, till light breaks upon us by sympathy. Some works would grow upon us continually if we could live with them, have them at home comparatively isolated, available not only for most favorable lights, but for our happiest moments of sensitiveness. As this may not be, it behooves us to learn the art of visiting galleries of art and large collections; of this a primary maxim is not to fritter attention, but concentrate it on what is best; in this way it is possible to learn a work of art even as we learn a poem, to carry it away in the mind with such perfectness that we contemplate it even in absence, and come to understand and feel it even better than when it was before us; and so whatsoever is a "thing of beauty" fulfils the promise of the poet, and becomes indeed "a joy forever."

W. Watkiss Lloyd.

CODE ADOPTED BY BOSTON MASTER-BUILDERS.



Entrance to Mr W.E.C. Eustis' House. Milton. Mass.
W. R. Emerson. Architect.

At a special meeting of the members of the Master-Builders' Association of Boston, held yesterday at 164 Devonshire Street, the following code of working principles for the year 1887 was unanimously adopted:

The Master-Builders' Association of Boston, after conference with the real-estate owners and architects of the city upon certain aspects of the labor question, do hereby adopt the following code of working principles in the hope that it will be accepted by all concerned as a rational and conservative method of meeting labor agitation in its relation to the building trades:

CODE OF WORKING PRINCIPLES.

Article 1. Change in method of payment for labor performed,

beginning at a date not later than the first day of April, 1887, we will pay for all work performed by journeymen or laborers in our various trades, at a certain price per hour. This price per hour shall be a matter of agreement between the individual workman and the individual employer. This change is not intended to apply to work known as "piece work," or work "by the year."

ART. 2. Hours of labor. — In order to rationally test the question of whether ten hours per day is too long for men to labor, and whether a less number of hours can be accepted as the measure of a day's labor without seriously retarding business enterprises, we will begin on the first day of April, 1887, to work nine hours in each working day, beginning at 7 o'clock, A. M., and ending at 5 o'clock, P. M., with the usual hour at noon for dinner, under payment by the hour as set forth in Article No. 1. All work done before 7 o'clock, A. M., and after 5 o'clock, P. M., to be paid for as overtime at such price as may be agreed upon by the workmen and employers. We will continue on this plan during the year 1887. If it is demonstrated that this change can be made without detriment to the interests of the workmen, or the owners, then the contractors will be satisfied, and if further reductions seem desirable they can be considered at the close of the year when this experiment shall have had a fair trial. If, however, there should be displayed a desire to disturb this trial by bringing on any general strike during the year 1887, then we shall feel at liberty to return at once to the old standard of ten hours.

ART. 3. Protecting clause in contracts, etc. — For the greater security of the contractor, we will demand the insertion of a clause in every building contract relieving the contractor from any forfeiture or demurrage on account of delays caused by strikes. This demand, we are assured by real-estate owners and architects, will be cheerfully granted. In case of a general strike, those men who wish to work, and will work, will be kept employed as long as there is anything to be done, and will be protected in their employment, provided they do not aid and assist the strikers by contributing to their funds; but men who engage in the said strike will not be re-employed until the said strike is completely over, or until they, as individuals, are willing to go to work on the same terms as above stated. In event of a strike, of any one special branch throughout the city, the men who will continue at work in that special branch will be kept employed the same as in a general strike, and all other branches of building will be continued with such men as will not contribute to support the strike. When a point shall be reached upon any building or buildings where further progress is blocked because of the said strike in a special branch, then the contractors in that special branch shall not be pushed or forced by their co-contractors to complete their work, but the said buildings shall be allowed to remain incomplete till a reasonable and satisfactory settlement be reached.

ART. 4. Improper interference with business. — Certain workmen have of late very improperly interfered with the carrying on of work by striking or threatening to strike for the most trivial causes, as follows:

Because certain other workmen were employed.
Because certain workmen were not employed.
Because certain workmen were discharged.
Because certain stock was used or was not used.
Because more than a certain number of apprentices were taken on, and for other equally untenable reasons.

They have also intimidated certain fellow-workmen by threatening that they would prevent their getting employment by refusing to work with them unless they joined certain societies. Such practices we condemn as most unfair and intolerable, and we agree that in case any workmen interrupt and embarrass our operations by such procedure, we will promptly discharge them and notify our fellow-members of the discharge. We also agree that all conspirators shall be prosecuted to the extent of the law.

ART. 5. Arbitration. — It shall be, as it always has been, the recognized right of the group of workmen in the employment of any individual contractor in the building trades to demand and receive from their employer a hearing upon any grievances that may arise, or any changes that may be desired; and at this hearing they can elect to be heard through a spokesman chosen from their number, or by their individual voices; but no person outside of the employment of the said contractor will be allowed to represent them. If amicable ground of settlement is not reached through such hearing, then the grievances shall be left to arbitration — should the terms of such arbitration be mutually agreed upon by the employer and his workmen — in the same manner that other business disputes and complications may be settled.

AGREEMENT.

We, the undersigned, in our individual capacities as contractors in the various branches of constructive work used in the erection of buildings, and as members of the Master-Builders' Association of Boston, hereby mutually agree that we will aid, support and assist each other in maintaining the same stand against improper dictation, as that taken and successfully held by us during the strike of May and June, 1886.

We pledge, in addition, that we will aid, support and assist each other in carrying out the letter and spirit of the propositions above described as our code of working principles for the year 1887.

We further agree that, should we differ from the opinion of the majority of our fellow-members, we will not in any way embarrass their purpose, but, recognizing the fact that uniformity of action is necessary for the proper trial of a scheme like this now proposed, we will faithfully carry out and support the plan agreed upon by the majority during the year 1887, and agree that any member deviating from the action decided upon by the majority will be considered amenable under Section 3 of Article 8 of our by-laws.

In testimony of our assent to the agreement and propositions before mentioned, we hereunto affix our signatures, and agree to faithfully adhere to the principles set forth.

We invite all contractors in the building trades whether located in this city or in any of the cities of New England, to join with us in this attempt to make fair trial of a scheme calculated, we trust, to set at rest labor agitation in our trades, and maintain unimpaired that necessary control and authority without which no enterprise can succeed. We invite all such contractors to call at our rooms and append their signatures to this code of working principles.

A true copy.
Attest: WILLIAM H. SAYWARD, *Secretary M. B. A.*

THE CATHEDRAL OF SIENA.



MR. W. D. HOWELLS, in one of his recent publications, has classed this exquisite building along with such objects as the Pyramids at Egypt, St. Mark's at Venice, the sweep of the Arno at Pisa, and the Falls of Niagara, characterizing them as things to be seen but not described. It may seem rash to venture upon a task forbidden by so high an authority, especially in matters Italian, says a correspondent of the *Glasgow Herald*, but for the benefit of many who have never seen Siena, and with the object of inducing visitors to Italy to include that most interesting old town in their programme, this article may not be altogether amiss. For it is to be feared that comparatively few out of the great stream of tourists find their way there, especially since the opening of the railway from Terontola to Chiusi, which is the route now taken by the express trains between Florence and Rome. Moreover, the attractions of other cities are so numerous and so powerful that naturally those whose time is limited pass over all save the five or six chief towns of the Peninsula. Siena, however, has a charm all its own, and a visit to it, however short, amply repays the time so spent. Its situation among the hills, at an altitude of over thirteen hundred feet from sea-level, gives it an atmosphere healthy and clear, and a temperature which in warm weather may be called cool when compared with the stifling airlessness of Rome, or the broiling heat of Florence.

The buildings of the town are disposed somewhat in the form of the three-legged emblem of the Isle of Man, a configuration due to the meeting of three spurs of hills upon which the place is built. The streets are all of them winding and narrow, while some of them are so steep as to be partly formed of steps, upon which vehicles without wheels are slowly dragged by oxen. Some of these narrow passages are built over in a way which, together with their steepness, recalls the closes of the old town of Edinburgh, only that they are much cleaner than those purlieus of the High Street of the Scottish capital. The principal street is the Via Cavour, which is approached from the railway station by the Via Garibaldi, and leads to the Piazza Vittorio Emanuele, a combination of honored names to be met with in every large town of "Italia Redenta." This Piazza, formerly called the Piazza del Campo, and mentioned by Dante in the eleventh canto of the "*Purgatorio*," is the centre of what life and stir are to be found in the city. It contains the Palazzo Pubblico, a large brick pile of the thirteenth century, with a tall and graceful tower.

While the chief activity of Siena is found in the Palazzo Vittorio Emanuele, its beauty and repose centre in the beautiful church in the Piazza del Duomo, on the highest part of the city. Victor Hugo has described Nôtre Dame at Paris as "*une vaste symphonie en pierre*," and as there are unfinished symphonies in music, notably that of Schubert, so there may also be unfinished symphonies in architecture, for the intention of the people of Siena was to erect an enormous cathedral, of which the present building would only have formed the transept, had not the evils of war and pestilence so severely crippled the resources of the republic that the ambitious plan had to be abandoned. The structure as it exists is thus a monument of what the piety of the Sienese enabled them to achieve, and of what their misfortunes prevented them from accomplishing. It is not of the colossal dimensions of many other celebrated cathedrals, being not more than two hundred and ninety feet in length and seventy-eight feet in width; but it possesses the usual component parts of a cathedral, viz., nave with aisles, choir, and transepts so proportioned as to produce a harmonious whole. The style of the work is Gothic, and the

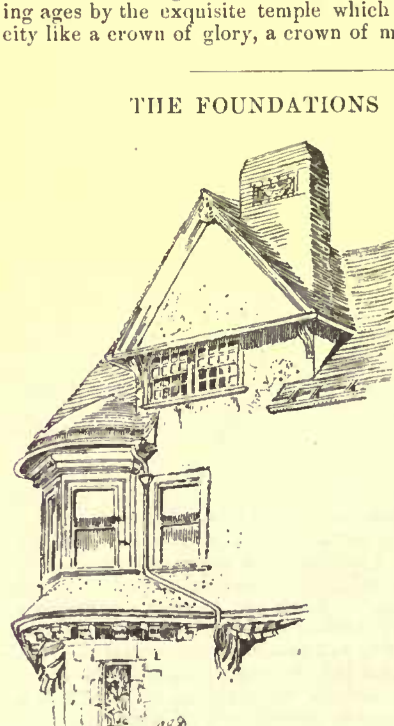
material used is marble, while its construction occupied about a century and a half, being completed in the year 1380. The side walls are comparatively plain, being built of white marble, with occasional bands of black marble, and they are pierced by the usual pointed windows, plain in the ground story and traceried in the clerestory, while statues are disposed along the top of the walls. The campanile, of alternate stripes of black and white, is placed beside the north transept, and rises to a height of six stories above the main building, terminating in five pinnacles. The façade is a singularly rich piece of work in white marble, relieved by panellings of red and black. It is a mass of beautiful sculptures of angels, prophets, animals, and other devices — a perfect romance in marble. The designer was Giovanni Pisano, and it is more than probable that this distinguished artist was the superintendent if not the actual sculptor of some part of its lovely carvings.

The doorways of beautiful clustered pillars give access to the interior of the building, where the arrangement of alternate bands of black and white marble is a very striking feature. The elaborately-carved arches of the nave are borne by handsome pillars, from the lower parts of which there spring with great freedom and boldness consoles, upon which are placed statues representing the founders of the various orders in the Catholic Church, while the cornice above the arches consists of long rows of busts of Popes in terra-cotta. The intersection of the nave and transepts is covered by a dome, which by some caprice of the architect takes the form of an irregular hexagon. The aisles and transepts are divided into numerous chapels, for the most part gorgeously decorated, in the sumptuous Roman style, with lapis lazuli and variegated marbles, and still further enriched with many treasures in sculpture, by such mighty artists as Michael Angelo, Donatallo, Nicolo Pisano, Giovanni Pisano, and Jacopo della Quercia. A soft yet bright light pervades the whole and blends into pleasing and satisfying harmony the boldness of the nave and the more exquisite portions of the building.

A unique feature of this beautiful sanctuary is the engraving upon the pavement, which is quite covered with *graffiti* representations of scenes and figures, chiefly from Old Testament history. These are protected by coverings of boards and floorcloth; many of the figures are simply outlined and filled in with black, while others are filled with materials of various colors, giving them more a pictorial than a sculptured effect. Under the dome are preserved the two flagstaffs which carried the ensigns of Siena on the *carroccio* or standard wagon of the period, in the great victory gained by the Ghibellines over the Guelphs in the year 1260, at Montaperto, a few miles distant from the city. Similarly are preserved in the Campo Santo of Pisa the great iron chains which closed the passage of the Arno during a war with Florence; and in like manner there is preserved, on the field of Bannockburn, the "Borestone," upon which King Robert Bruce is said to have planted the lion rampant on the day of Scotland's great national victory.

About the middle of the fourteenth century misfortunes overtook the vigorous little republic "on Tuscan hills," for a time the rival of Pisa and Florence, but the piety, the patriotism, and the love of art which then distinguished its citizens are commemorated to succeeding ages by the exquisite temple which sits upon the brow of their city like a crown of glory, a crown of many gems.

THE FOUNDATIONS OF VENICE.



Longwood Ave Brookline. Mass / E. Tobey Arch't

THROUGH the kindness of Signor Boni, one of the architects of the Ducal Palace, I have been examining the data gathered by him and his colleagues, says a correspondent of the London *Times*, as to the methods of the builders of Venice in preparing the foundations of their structures, data which furnish information of interest to those who love the city of the lagoons.

Signor Boni's examination of the cylinders drawn up from the artesian borings shows that the subsoil of Venice for at least 200 metres is an alternation of clay, sea-sand, mud, and carbonaceous matter, showing that for ages before Venice existed its site was exposed at long intervals to the action of rivers, to the sun, and then to the sea, no fewer than ten different strata showing the evidences of as many periods of exposure to the sun, having been covered by vegetation, and then re-immersed, the sea coming and receding, followed by the floods from the mountains again. The present period of exposure has been a much longer one than has generally been imagined, for Cavalier Battaglini, the zealous custodian of the museum of Sorallo, has found in his excavations on the islands vases of early Italic type, with others Etruscan, and many of the early Imperial epoch, so that when the people of Altinum fled before Attila they took refuge in well-known and inhabitable localities, though sea-built isles.

When, therefore, it was intended to place the foundations of a mass of masonry like the palaces of the twelfth to fifteenth centuries, or the huge piles of the campaniles, the practice was to excavate the unstable soil and *débris* of depositions, the constructions and demolitions of centuries previous, until solid clay was reached, rock being out of question at any depth. The first layer of clay being reached, piles were, when great stability was needed, driven in and down to and through the next stratum of firmer and more resisting clay into the stratum of sand beneath. These piles, first driven in a hollow square, were then driven within it until the square was filled as close as piles could be driven, and the interstices with fragments of stone rammed in. On this a raft of oak planks several inches thick was laid, crossing in double layer, and on this were deposited masses of squared stone up to the wall bases. This wood, laid in the fourteenth century, is still found in perfect preservation. This, at least, was the process followed in the construction of the campanile of St. Mark's, the foundations of which were recently laid bare by Signor Boni, and the surprising fact was learned that this foundation, bearing the greatest weight per superficial inch of any substructure in the world, only widens about two metres on fifteen square at the pavement from the base of the campanile to the *palafitta*, as the mass of piles is called, a depth of five metres. And this is the most solid foundation yet explored. That of the Ducal Palace lacks the *palafitta*, the stones of the substructure, 2.88 metres deep, being laid directly on the first stratum of clay, and this in the structures of the various periods; that of St. Marks has a *palafitta* only 2.10 metres deep. The foundations of the church of the eleventh century show better work and better materials than the later constructions, the marble shell which was added a century later having only a semblance of foundation, even less than was the case with the pavilions of the southwest and northwest angles already described. This *palafitta*, where it exists, does not go down to that deep stratum of clay of great firmness on which the campanile rests, and therefore is more liable to subsequent and unequal subsidence, the stratum of clay on which the *palafitta* rests being unequal in thickness as well as compactness.

Now, as we do not know how far the general subsidence or elevation of the surface of the island has gone since the date of these constructions, it is impossible to determine exactly what may be the subsidence of the structures; but we have in St. Mark's an inequality between portions that must have been on a level once of nearly or quite a quarter of a metre in the width of a portico. The campanile must have subsided as a whole, for the weight of the mass, calculated at nearly 20,000 tons, could not fail to make an impression on the stratum of clay already entirely traversed by the *palafitta*, the points of which enter into the sand beneath it, and it has certainly not failed to produce the partial subsidence which is found more or less in all Venetian buildings, the north side of the campanile having reached the perpendicular from the gradual greater subsidence of the foundation on that side, and the old pavement of the square is found at 72 centimetres below the present. A similar difference is found in the Ducal Palace, where were in the original construction three steps leading from the piazza up to the floor of the arcade now on the same level. But this difference is difficult to apportion, as we have no data from which to prove the original elevation above the general surface of the island. What is clear is that the site of the Ducal Palace was much more trustworthy and equal than that of St. Mark's, as the permeability of the latter is still very great, the rise and fall of the tide being visible in that portion of the first church which lies under the great dome, as may be seen through the little window in the enclosed portion of it. The Ducal Palace, if sinking, is sinking solidly and equally, and though by its construction necessitating ties and braces of iron, does not show any serious cracks such as appear in St. Mark's, which, considering the slight difference in the substructures of the two buildings, can only be due to the fact that the palace was built on a natural ridge, and the church on a more or less artificially formed soil.

This partial subsidence is the cause of the precarious state of St. Mark's, and, were the means forthcoming, would justify a far more radical statical restoration than anything hitherto attempted. This subsidence, besides the fracturing of the walls and general injury caused to mosaics and marbles of the facing is, as I before said, destroying the pavement, and the committee of the English Society for the Preservation of Ancient Monuments, in the protest to which I have alluded, adduces the fantastic theory that the pavement was originally made undulating to show that St. Mark ruled the waves. It ought to suffice to study with even slight care the pavement itself to recognize the absurdity of this idea. In the first place, the position of the piers beneath is tolerably well indicated by the thrusting upward of the pavement, and then it will appear clearly, if one will examine the splendid slabs of Greek marble which cover a great part of the pavement of the nave, of which those under the nave, about twelve feet by five feet, are all sawn from one block, and were clearly intended to preserve their plane surface, but are now cracked, or in some cases badly broken over the resisting points of the substructure, the number of the fragments varying from half-a-dozen to three dozen,

all, however, being broken. Of this the just issued annual report for this year says: "In the interior of the church one of the most urgent works is the reconstruction of that large portion of the pavement which lies under the central cupola, and this on account of the unequal subsidence (*avvalamento*, valleying) which seems to be increasing, and which causes numerous and dangerous falls." This portion of the church is that before the pulpit of the Patriarch, and the present state of it is a positive danger to his audience, which certainly was not the intention of builders of St. Mark's. I am glad to see that the report recognizes the necessity in the future of the complete restoration of the pavement, some of the most interesting designs in which are already destroyed beyond recovery by wear, though for the present these plans are simply recommendations for consideration of the Government of Rome, which, on the recommendation of the Commission for the Preservation of Ancient Monuments, decides what part of the suggested works shall be carried out. And since I am on this subject I will, for the information of your readers as to the effects of the subsidence spoken of, quote a single sentence from Dr. Saccardo's report of the restoration of the ancient chapel of St. Isidoro: "the roof showed, still open, the crevices produced by ancient movements of who knows how many centuries, movements so great and grave that the head of one of the figures in the mosaic was removed a good palm from the body."

Of course much of this insufficiency of the foundations of St. Mark's is due to the facts that the church was not in its beginnings calculated for the scale which it has reached, and that work of the eighth century, which was for its then uses sufficient, became by the later additions buried beyond reach and reinforcement of the architects of the twelfth century, during the interval between which periods it was in progress. The basilica had four centuries of construction, four of embellishment — it is approaching its fourth of nursing and more or less intelligent restoration — in all a history unique in the existence of architecture.

COMMUNICATIONS

THE MIXING-CHAMBER FOR HOT-AIR HEATING.

NEW YORK, September 28, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In "An Editor's Trip Abroad," of your journal of the 25th instant, page 145, the following sentence occurs: "As in Trinity Church, Boston, and perhaps in other American buildings, M. Nénot had provided for converting the whole of the basement beneath his principal room into a warm-air chamber, with openings through the floor at suitable points." Permit me to say that this system of heating was applied by me in the Fifth Avenue Presbyterian Church, in this city, without knowing that it had ever been done, and several years before Trinity Church of Boston was built. The Building Committee of that church, or some of its members, visited the Fifth Avenue Presbyterian Church, apparently before any scheme of heating was adopted, as shortly after this visit I received a letter from the Chairman asking me to give him a full explanation of the mode of heating at the Fifth Avenue Presbyterian Church — generally known as Dr. Hall's Church.

Respectfully, CARL PFEIFFER.

INTERMITTENT *VS.* PERSISTENT DISCHARGE FOR SUBSURFACE IRRIGATION.

NEW YORK, October 4, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Referring to a communication in your issue of September 18, we desire to say that in our experience we have found that an intermittent discharge is *not* absolutely necessary in a system of sub-soil irrigation. The former chief engineer of this company, Mr. W. Paul Gerhard, executed a plan of his own devising at Montclair, N. J., where the discharge was a simple overflow into absorption tiles, which has worked satisfactorily for more than two years. The ground is a stiff clay, and without slope. The same plan has been repeatedly used by us for single dwellings with uniform results. The public want as little machinery as possible with their sanitary arrangements. Very truly yours, C. W. DURHAM, C. E.

[To this we can only say that we are as much surprised that this arrangement has not been clogged with grease and sludge, as that Mr. Gerhard should recommend it. We have known the same thing done, and have used it several times ourselves, but the fouling, although slow, is so complete without the intermittent discharge that we believe the more expensive arrangement to be cheaper and better in the end. — EDS. AMERICAN ARCHITECT.]

GERMAN MIDDLE-CLASS HOUSES.

NEW YORK, October 2, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — While sojourning recently in one of the German capitals, my attention was particularly called to the easy and simple manner in which the Germans live and keep house, as compared with that of our own people, who dwell in rented houses in New York and other of the principal American cities, the difference arising particularly, I am persuaded, from the construction and arrangement of the dwellings themselves. I refer now to houses of that class of society who are neither rich nor poor—the so-called middle class—who usually, here in New York, rent houses at prices ranging from eight hundred dollars to fifteen hundred dollars per annum, but who seldom live in flats or own houses of their own. The reason that this class of people do not more generally live in flats or apartment-houses is simply because few such buildings, adapted to their necessities and means, have yet been erected. But there is every reason to believe that many of their number, like some of the more wealthy, who can afford to pay three or four thousand dollars a year, would be very willing to exchange their three-story, high stoop, and often ill-constructed dwellings for apartments of an equal number of rooms, having the attributes of perfect light, ventilation, privacy, etc., at the same rent as they now pay, could such be had in New York. I believe that such apartment-houses may be built, rented at eight hundred dollars to fifteen hundred dollars per suite, and allow the owner a handsome interest on his investment. Let us compare, briefly, the dwellings of this class in New York with those of the same class in the larger cities of Germany. Everyone knows what the ordinary twenty-foot, three-story house is here, with its high stoop, brick or veneered brown-stone front, uninviting basement dining-room, with kitchen back, narrow hall, and parlors in first story, with a repetition of the same hall and stairway in the second and third stories, and too often with defective plumbing and poisonous coal gas. The work required to keep such houses in order, not to mention the usual disadvantages of poor light and ventilation in the halls, is almost double that required by the German dwellings. There the houses are built free on all sides, are usually four stories in height, accommodating one family on each floor. The staircase is broad, has windows at each landing, and every apartment has its individual entrance and bell. The buildings are ordinarily about square, the main rooms grouped about a central hall, the kitchen and servants' bed-room being separated by an entry. All rooms are well lighted, have perfect ventilation, and, being on one floor, half the labor of housekeeping is avoided. I think it scarcely requires argument, that such flats in New York, with the addition of the best modern plumbing and steam-heating, which have not yet been introduced into the houses in Germany, would find ready occupants as fast as they could be erected. But until capitalists are assured of a fair return for the money invested, such buildings will not be built, as many even of those apartment-houses, where the suites rent from three to four thousand dollars have not been financial successes. However, I think to those having money to invest, apartment-houses for just this middle class of people is a subject well worthy of consideration: they desire neither the luxury of a palace nor the shabbiness of a French flat, but as much room, and more light, air, ventilation and comfort than can be obtained in the ordinary twenty-foot dwellings above referred to.

Take, for instance, a plot of ground two hundred feet square, that is, sixteen city lots, which, at ten thousand dollars per lot, makes a total of one hundred and sixty thousand dollars for the entire plot. This would allow of the houses being built in a desirable locality. Erect eight detached buildings, averaging forty by sixty-five feet, and five stories high, so arranged that there is a space twelve feet wide between each two, a portion of which would be utilized for the stairways and elevators, which would be constructed wholly outside of the main walls of the buildings. Such structures, supplied with steam-heat, the best of plumbing, neatly finished, and each and every room having direct access to the air, and, consequently, proper ventilation, would cost not to exceed sixty thousand dollars each, making a total for the eight of four hundred and eighty thousand dollars, and a grand total for the whole investment of six hundred and forty thousand dollars. The entire structure could be planned to accommodate sixty families, at an average rental of twelve hundred dollars, making a total of seventy-two thousand dollars as the gross receipts for all the apartments. Now, deduct twenty-five thousand dollars per annum for taxes, insurance, gas, coal, and wages of employés, etc., and we have forty-seven thousand dollars as the interest on an investment of six hundred and forty thousand dollars, or a little more than seven per cent. The benefits derived by the occupants of such apartments would be, chiefly, perfect safety from fire, each floor being intact, as staircases and elevator-wells are entirely outside of the buildings (there are no light shafts); the utmost privacy, as each has its own entrance and vestibule; perfect light and ventilation, and, on account of the arrangement of the rooms, the least possible care to the housekeeper, besides all of which, such as steam-heating, plumbing, and elevator service as are found in the most costly apartment-houses in the city. J. R. H.

NOTES & CLIPPINGS

SHINGLES ONE HUNDRED AND FIFTEEN YEARS OLD. — A Danielsonville correspondent of the *Sun* writes as follows about the shingles removed a few days ago from the steeple of the Unitarian church at Brooklyn: "One of the first pastors of the church nailed them with big-headed wrought-iron nails to the steeple in 1771, and under them General Israel Putnam often has sat and listened to the discourses — rare in these days — giving liberal interpretations of the Scriptures. It is stated also that the shingles were 'rived' by men who afterward fought with Old Put at Bunker Hill. The shingles are remarkedly well preserved. Four of them are displayed in the street windows of the *News* office, in this village, and above them is a placard with this reading: 'These shingles were in use on the Unitarian church in Brooklyn 115 years. Just look at the nails.' The nails are fine specimens of old

fashioned, pains-taking workmanship. They are smooth, straight and round, with large, thin, perfect heads, and are as clean and bright as at the time they were driven into the steeple. They would be considered to-day too valuable to use in any except the most elaborate and costly work. The shingles, which are of red cedar, are not at all decayed."

The Iron Spire of St. Stephen's, Vienna.— The tower of the ancient church of St. Stephen's, Vienna, which is supposed to have been founded in 1144, was greatly injured by an earthquake in 1519, and it was necessary to restore it. In course of time it deviated out of the perpendicular to a considerable extent. An iron bar was carried through it as an axis for the support of the spire, which, having a considerable tendency to vibrate, might be considered as an element of destruction rather than of strength. Consequently the thin wall of the lower portion of the spire was reduced almost to a ruin, and at length was in such a dangerous condition as to require rebuilding. The removal of the old spire was commenced in August, 1839, and in the following spring all the condemned parts had been removed. The mode of construction adopted in the restoration was novel and ingenious, the slight masonry of the spire being supported by means of a framing of vertical iron ribs, fastened at their lower extremities to a cast-iron plate or base, and united to each other at intervals by horizontal rings of rolled iron. These rings are made to project from the inner surface, so as to admit of a person ascending, with the assistance of ladders, to the top of the spire. All the wrought and rolled iron employed in the construction of this iron skeleton, the weight of which was only 123 hundredweight, was manufactured in the Government works at Neuberg, in Styria. The cast-iron plates or rings were furnished from the Government iron-works at Mariezell. In the autumn of 1842, when the whole of the masonry of the spire had been completed, the upper portion, consisting entirely of ironwork, was fixed. This also was attached to a strong cast-iron circular plate, similar in construction to that below. This portion of the framing, with the other ironwork employed in the spire, weighed about 80 hundredweight, so that the entire weight of iron was about 203 hundredweight. The new portion or the spire was connected to the old by means of an arrangement of iron anchor fastenings. The portion of the spire restored (viz., from the gallery of the tower to the top of the cross), is about 182 feet high, the cost having been about 130,000 gulden (£13,000), of which sum 15,500 gulden were expended in taking down the old spire and in the construction of the necessary scaffolding.—*Iron.*

What is "Tenantable Repair"? — A much-vexed question between landlord and tenant had a little light thrown upon it on July 29 by the Court of Appeals in the case of Crawford and others *vs.* Newton. By an agreement for a lease, a tenant contracted to take a house for a term of five years, and to "keep the inside of the buildings in tenantable repair, and so deliver them up at the end of the term." The tenancy was continued beyond the five years, as a tenancy from year to year on the terms contained in the agreement until 1884, when the tenant gave up the house. The plaintiffs sued for damages for breach of the provision to deliver up the buildings in tenantable repair. It appeared that the tenant had not painted or papered the house during the tenancy, and certain parts of the woodwork were worn away or decayed, and holes were left in the walls where the tenant's fixtures had been removed. Mr. Justice Cave, before whom the case was tried, held that the tenant was not bound to paper or paint or to put the house into decorative repair, but allowed the plaintiffs £20 for structural repairs, such as replacing the decayed woodwork and repairing the holes in the wall, and also for an extra coat of paint rendered necessary in one portion of the house where the woodwork had decayed. From this judgment the plaintiffs appealed, and contended that under the words "tenantable repair" the tenant was bound to deliver up the house in such a reasonable state of repair both as to paper and paint and otherwise that a new tenant could take it. The Court dismissed the appeal. The Master of the Rolls said that the case was fought by the plaintiffs at the trial on the ground that they were entitled to have the house papered and painted so that it should be in the same condition as when the tenant took it, and that the damages ought to be assessed on that footing. The learned judge came to the conclusion that the plaintiffs were not entitled to that extent. He decided that where any waste had been committed they would be entitled to compensation for that. As to the painting, he said that some paint might be necessary to prevent the woodwork from going to decay, and he held the tenant bound to paint to that extent; but beyond that he held that the tenant was not bound to paint, as that would be decorative painting, and "repair" had nothing to say to decoration. The question was whether the learned judge was bound to go farther and hold that the tenant ought to have painted and papered where painting and papering had been done before. It was unnecessary to determine the exact meaning of the provision as to "tenantable repair," though perhaps it would be very desirable to do so. But, at any rate, one might say that it only referred to the question of repair and not to the question of ornamentation. It was sufficient to decide this case to say that decorative painting, which was not wanted for the preservation of the building but for ornamentation, could not come within the terms of this provision or covenant. The same remark applied to papering, which of necessity was mere ornamentation. So without saying what "tenantable repair" was, it was sufficient to say that papering and painting beyond what was necessary to keep the house in repair did not come within its terms. The judgment was, therefore, right.—*Sanitary Record.*

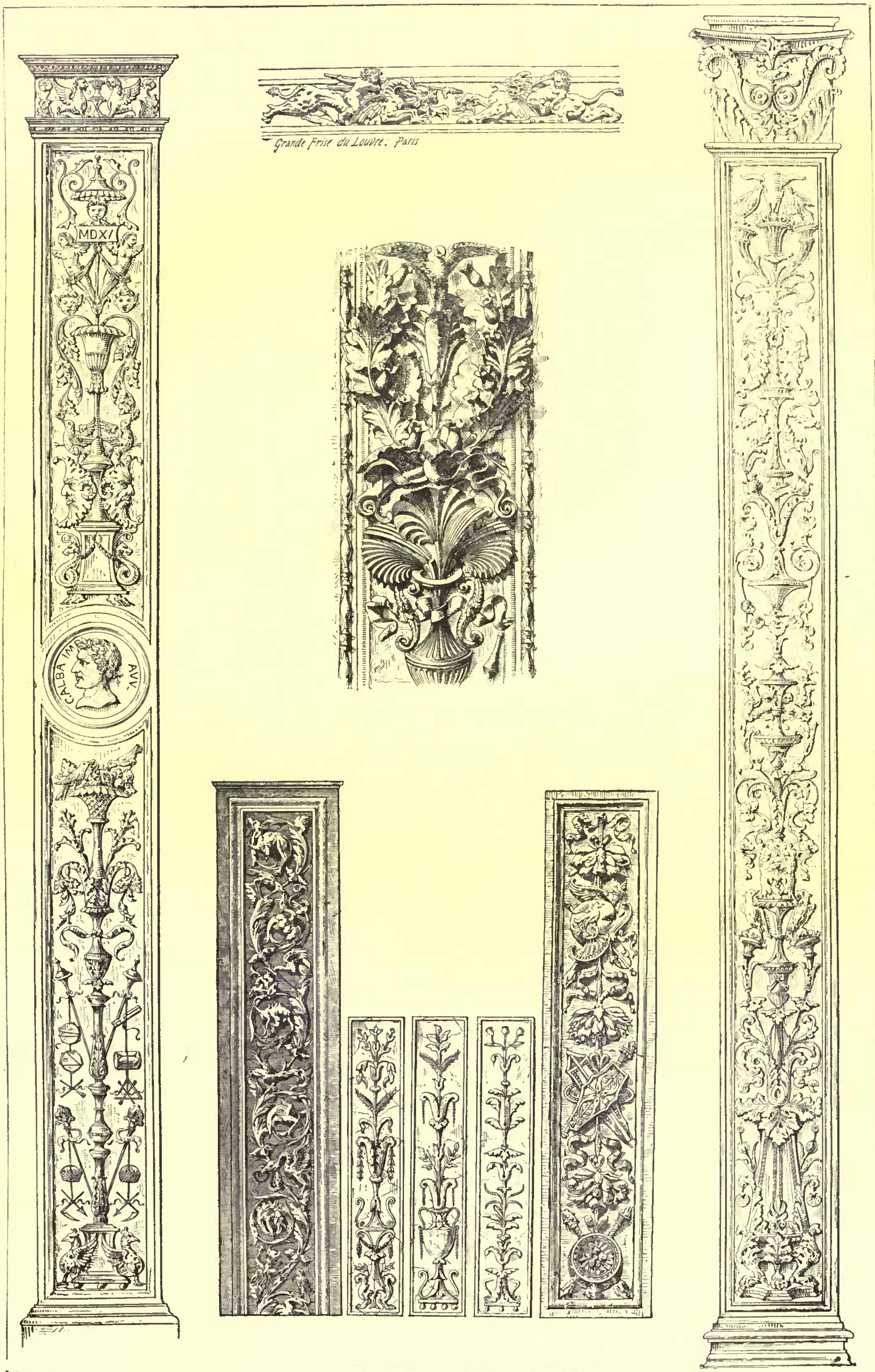
TRADE SURVEYS

The past few days have developed a number of interesting tendencies and factors, by which the course of trade for the coming six months can be more clearly traced. In the first place, there has been a marked advance in the prices of several products. In the next place, there has been a rush of orders and inquiries for material. Then, manufacturers have, in many cases, refused orders, assigning, in some instances, the reason that they were unwilling to book large orders at this time, because of the uncertainty as to the price of material sixty or ninety days hence. In addition to this, manufacturers, builders and contractors have been able to see a little more clearly into the future. They find that the requirements in all directions will be very heavy; in fact, extraordinarily heavy. This enlargement of consumptive requirements has been brought about partly by the necessity under which capital finds itself for securing employment, wherever employment can be found. It is travelling into the far West and far South, and confidential agents of large financial concerns are now carefully investigating the possibilities of schemes of an industrial character, in remote localities. There are other influences at work, to account for this enlargement of consumption, the most potent of which is, the increased-earning capacity of the masses, who are, and for months have been, well employed and well paid. Elements of disorder have been removed, or corrected, by the operation of natural laws, in an unobserved way, and the entire country finds itself, in the autumn of 1886, in a toned-up condition, with its energies freshened, and its comprehensions of business possibilities greatly enlarged. We are not deceiving ourselves in saying and believing that the coming six months, and very probably the coming twelve months, will be periods of unusual industrial and commercial activity. A year ago, the possibility of the return of such a season as this was seriously doubted. The enormous machinery capacity, railroad capacity and money capacity, was thought to be then far beyond the limits of probable requirements. But here we are already, leaping ahead of facilities and of supplies. All of the industries are crowded. There is scarcely any idle labor. New industries are springing up in the West and South. The iron trade is in a better condition than it has ever been; not in one or two branches, but in every one. Crude iron has advanced fifty cents per ton for the special makes; refined and medium iron, besides tank-plate and steel-iron, are all very strong and active, and both manufacturers and buyers are expecting a further advance by November I. Mills are sold from one to three months ahead, and buyers of small lots of material find it difficult to secure supplies within sixty or ninety days. The bridge-builders are very busy on winter and spring orders, and during the past week specifications were submitted for material calling for eight or nine thousand tons, at least. The rail-mills are scarcely able to accommodate December or January buyers. Old material of all kinds is scarce and active, and prices have advanced 50 cents to $1 per ton. In the lumber trade there is a healthy scarcity of building material, but not such as is likely to create a general advance. Retail dealers are carrying light stocks. Wholesale dealers have taken the alarm, and are purchasing as quietly as possible, without alarming the trade. Eastern supplies are heavy, but in view of the enormous consumption, they are not likely to depress prices.

In the coal trade a general advance has just taken place in anthracite, and an improvement is thought probable in the bituminous centres of the Western States. The Governor of Pennsylvania has seen fit to direct that steps be taken to ascertain whether the anthracite coal combination is violating the organic law of the State. The anthracite companies expect to advance prices still further during the winter, in both Eastern and Western markets. In Chicago the Western Combination met last week and resolved to take out of coal all there was in it. In other industries, such as the textile industry, there is greater activity than ever before known in its history. Wool is very strong, and still advancing. Cotton is a trifle higher. Textile products of all kinds are bringing asking-prices, and manufacturers are unable to more than keep pace with the urgent demands of jobbers and buyers.

In building matters there is necessity of noticing some little falling off in several cities and localities. Throughout New England, especially in the towns and villages, a fair degree of building activity is generally reported. Architects and persons interested in real-estate operations, think it probable that small house-building will assume much larger proportions next year than this year, mainly for operatives' requirements, and some architects are now at work on plans for small houses of an attractive appearance and comfortable interior, which can be built at small cost. There is room for enterprise and talent in this direction. The abodes of the operative classes are too generally neglected by architects, and even by builders, and nowhere else than in New England can the needed reform be set in operation. The figures showing real-estate operations in New York indicate a great deal of activity, and a sharp increase over last year. The figures, as given by an industrious contemporary show that, for the first nine months of this year, the conveyances numbered 10,299, representing in round numbers, $186,000,000, against 8,237 conveyances for the same time last year, representing in round numbers, $133,000,000. The corresponding figures for mortgages were, 9,290, and 7,451, and the sums of money $104,000,000 and $76,000,000 respectively. So far this year the buildings erected, and for which permits are taken out, count up $50,000,000 in round figures, against some $36,000,000 for the same time last year.

In Philadelphia the number of permits granted since January I foot up 3,117 against 2,958 for the same time last year. The number of operations have been 7,661 against 6,496 for same time last year. The number of two-story houses built, or for which permits have been taken out, are 4,079 against 3,650 for the same time last year, and for three-story houses 1,699 and 1,311 respectively. Going farther West we find a very general improvement in building activity in Pittsburgh, and in a half-dozen active manufacturing centres within a hundred miles. Along the Ohio Valley the reports during the past week have been more encouraging, although there is no very great rush in building. In Chicago there is a perceptible decline in heavy operations, but there is the promise of improvement in small houses, especially along the lines of the several roads leading out of that city. Real estate has been picking up along those lines, and, according to some opinions, there has been an advance in the value of city real estate in many of the larger towns along the trunk lines, between Chicago and New York. There is certainly no evidence of any retrogression. On the other hand, all of the conditions are favorable to an increase in house and shop building. The industries between these two great cities are vigorous, and there is nothing to interfere, so far as is observable, with the continued healthy development of all the industries, great and small. In the farther Northwest the same general conditions exist; but the ups and downs of trade are more quickly and deeply felt, because the newer sections are subjected to numerous unsettling influences, such as good and bad crops. Throughout the Mississippi Valley there seems to be a genuine revival at work, but this depends upon the certainty of good agricultural results. If the Mississippi does not overflow, if there is no repetition of strikes — and there is not likely to be — if cotton advances in price, as it is likely to, and if the crops are favorable, as is very probable, the spirit of improvement will take a fresh start, and a great deal of willing capital will find its way through that rich valley and lend a helping hand to struggling industries as well as to struggling agriculture and transportation interests. The great interior is offering numerous inducements now, and with a continuation of the present healthful tendencies, these opportunities for the investment of money will increase in number and broaden the opportunities for the builder, the architect, the carpenter, mason, bricklayer, painter, and decorator.



ITALIAN RENAISSANCE SCULPTURE.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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CONTENTS

CERTAIN manufacturers in Pennsylvania seem to be disposed to emulate the worst of the trades-union doings in their dealing with their employés, and we hope that they will be sharply looked after. It seems that the men in a certain mill in Frankford took a dislike to one of their fellows, and demanded his discharge, enforcing their demand by leaving their work until it should be granted. As persons of ordinary intelligence must have a pretty serious grievance against a man to be willing to sacrifice their wages to have him taken out of their way, one would think that the matter presented an excellent subject for friendly discussion between the employers and employed, and perhaps for arbitration, but the Frankford mill-owner thought otherwise, and, instead of trying to come to an understanding with the poor people dependent upon him, he called on the other members of the manufacturers' association to which he belonged to "support" him by turning all their employés out of doors. This, with a blind obedience worthy of the most fanatic trades-unionist, they immediately did, cutting off nine hundred of their unoffending fellow-citizens from their daily work, and depriving their unfortunate families of their bread and butter. This, however, did not satisfy the injured dignity of the manufacturers. Something, apparently, having been said about furnishing pecuniary assistance to the locked-out workmen from labor societies outside the city, the manufacturers' association gave notice that if any one outside of Frankford took pity on their starving men, they would at once close all the mills in the city, turning seventy-five thousand innocent and helpless men and women into the streets, to beg, or steal, or die. We trust, for the honor of humanity, that this horrible threat will not be carried out. The annals of the doings of trades-unions are bad enough, but the worst brutalities of rattening and mill-burning would be trifles in comparison with the crime of depriving at a blow seventy-five thousand people of their living, just at the beginning of winter, simply because one man, of whom very few of the victims had ever heard, chose to make himself, through his choice of subordinates, disagreeable to his dependents, and finding the latter not quite so submissive to his will as he liked, took advantage of his relations with other manufacturers to revenge himself by the ruin of a whole community.

A CURIOUS conspiracy is said to exist among the dealers in coal-tar in the cities of the Middle States, by means of which the price has been raised to exorbitant rates. According to the Philadelphia *Press*, the combination includes dealers in Philadelphia, Pittsburgh, Cincinnati, Washington, St. Louis, New York and Boston, and holds, as a means for enforcing its rules, a fund of more than two hundred thousand dollars, contributed by the members, each of whom agrees to forfeit his share in the fund if he violates the dictates of the association. One of the rules is at present that each member shall have unmolested control of the market in the place where he lives, and his associates are prohibited from selling any tar whatever to persons within his jurisdiction. Another rule appears to be to put up the prices to the highest possible point, and this is said to be now from three dollars and a half to four dollars a barrel, according to the quantity taken, the cost to the dealers being about eighty cents. As the addition of four hundred per cent profit to the cost of the goods naturally checks sales, a third rule is said to be in force, by which the surplus stock, which cannot be sold, and is too bulky to store with advantage, is to be regularly destroyed. Some of the Philadelphia contractors, who use coal-tar in great quantities, naturally dislike paying so much for it, and have, it is reported, endeavored to procure it elsewhere at a price more nearly in conformity with its cost. From the dealers in other cities they got no satisfaction, as these, belonging to the combination, refused to sell to them, but they discovered that coal-tar could be imported from England at a cost of about one dollar and a quarter a barrel, and one or two of them accordingly bought English coal-tar for their purposes. The American combination, however, was equal to the emergency, and, as the *Press* says, proceeded to coerce the offending contractors. One of them, who had been guilty of buying English tar, found himself charged nine dollars a barrel for the next American tar that he bought, and the American ring is said to have controlled some of the inspectors of the Philadelphia paving-department, which uses large amounts of tar, who rejected all work in which they discovered that tar not sold by the combination had been employed. There is probably some exaggeration in the Philadelphia accounts, but as an enhancement in the cost of coal-tar is a matter of considerable importance in building, it will be interesting to know whether the present prices are kept up artificially, and if so, whether there is no means of reducing them.

WE regret to hear of the death at Cincinnati of one of the most respected architects in the city, Mr. William Walter, who, as we learn from the *Commercial*, died last month after a long illness. Mr. Walter was one of the pioneers of Cincinnati, having been brought there by his parents from Pennsylvania in 1828, when he was thirteen years old. His father, Henry Walter, was an architect of the old school, and the young William, after serving an apprenticeship to a builder, entered his father's office, and with him designed the rather famous State Capitol at Columbus, as well as St. Peter's Church in Cincinnati. To these succeeded many other commissions, and Mr. Walter continued in active practice until about eight years ago, when an attack of paralysis warned him that his overtasked system was giving way. He recovered in part from this, but a second stroke prostrated him, and after years of patient suffering, at last put an end to a long, happy and useful life.

MANY architects and others in the Eastern States will hear with regret of the death of Col. Francis L. Lee, one of the oldest and best-known landscape-gardeners in the country. Colonel Lee was born in Boston in 1823, and educated at Harvard College. He inherited a considerable property, and might have spent his life in idleness, but for his passionate love of nature, which led him to devote himself, with a zeal that few professional men throw into their work, to the pursuit of the art which gave the best opportunity for the studies which most attracted him. Too much engaged, perhaps, by the distractions which are inseparable from wealth and position, to give his mind to very important commissions, his practice was chiefly among private proprietors, for whom his exquisite taste did wonders in the development of those beauties of form and color which the good landscape-gardener manages so skilfully. Perhaps the most remarkable characteristic of his work was its subtilty of effect. Although he inclined usually to a natural treatment, as distinguished from the artificial management of grounds, there was nothing careless about his composition. The commonest tree or shrub was to him a means of expression of which he knew perfectly the value, and he used the tints of leaves and modes of branching, as a painter uses lines and colors in his picture. Personally, Colonel Lee would, by strangers, hardly have been suspected of the delicacy of perception which showed itself in his work. Brought up to outdoor pursuits, and associating in consequence chiefly with men, among whom he was very popular, he was rather remarkable for a bluff masculinity which those who knew him soon found

to be only the superficial covering of the kindest and most honest of hearts, and the sensitive feeling of a true artist.

A CURIOUS accident, which had fortunately, no consequences more serious than the destruction of twenty-five thousand dollars worth of property, happened on Long Island not long ago. Every one knows the cylindrical iron reservoirs which have become so popular among the engineers of small town water-works, and already disfigure so many pretty hills, and it is not surprising that the King's County Water Company should have had one built for the purpose of supplying the villages about Coney Island; but the Company required an unusually large one of its kind. For some reason, it was built two hundred and twenty-seven feet high, sixteen feet in diameter at the base, and eight feet at the top. According to the rather unreliable accounts in the newspapers, the plates at the bottom were one inch thick, diminished in thickness toward the top. The whole was of steel, apparently of some quality hitherto unknown, since, according to the Boston *Herald*, the tower was "supposed to be able to resist a pressure of sixty thousand pounds to the square inch." On the completion of the tower, it was tested by filling it to the top with water. Hardly had the pumping ceased when one of the plates near the bottom burst, breaking in two, and allowing a jet of water to escape; and in a moment the tower separated into a dozen pieces, the water poured out in all directions, and the mass of steel fell to the ground. The young engineer who directed the testing was standing close beside the tower when it burst, but happily escaped with no worse harm than a thorough drenching. Not pretending to any skill in hydraulics, we will not attempt to explain the accident. According to Trautwine's formula, which we take to be reliable. the plates were of ample thickness, even if they had been of iron, instead of that wonderful steel which is described, and the most rigid inspection is said to have been given to the material, so that the bursting seems to have been due to one of those unaccountable freaks of steel, the list of which is so rapidly extending.

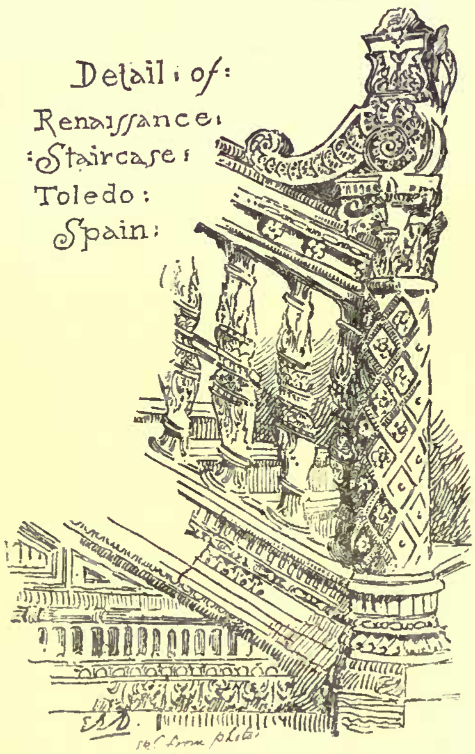
THE question of the validity of laws in relation to contracts for labor was recently brought up before the United States Circuit Court in Detroit. As every one who reads the speeches of politicians must have observed, it is common now to talk about imported contract labor with affected horror, as if it necessarily involved the abuses of the coolie system; and the popular prejudice has been reflected in legislation, avowedly designed to protect workingmen against competition, to the disadvantage of those who employ them. Not long ago a shipbuilder, living near Detroit, suffered from a strike among his men, and crossed the river to Canada to get others to supply their places. He made agreements with a number of men to come and work for him, but no sooner had they arrived than they were sent home again by the striking workmen, who followed up this proceeding by prosecuting their late employer for violation of the contract-labor law. The counsel for the defence, instead of smuggling his client away under a cloud of exceptions and delays, chose, fortunately for the public, to attack the law itself. We do not pretend to any knowledge of legal science, but it seems to us that some of the points in his argument were very well put. In regard to his client's violation of the United States law in making contracts for labor in Canada, he said that there was no law against this in Canada, and argued that a man could not be punished in the United States for doing something in Canada which was perfectly legal in that country, which, by the way, is the same doctrine that the United States Government has itself been rather strenuously maintaining in another case. Moreover, as a foreigner has a perfect right to come to the United States and work without any contract, Mr. Griffin inquired, somewhat pertinently, why it should be made criminal for any one to hire him to do what he was free to do without being hired, and suggested that the law was here guilty of a slight absurdity. What will be the decision of the court no one can say, and the questions involved are so important that the case may be carried to the Supreme Court of the United States.

AS contrasted with the socialistic view of high explosives, the scientific method of treating them, though less familiar, is interesting. The most extensive investigation yet undertaken into their properties is probably that which has for years been carried on at Willett's Point, in New York harbor, in connection with the United States torpedo-station there, some of the results of which were utilized in the operations among the East River reefs. The usual method of testing dynamite, or similar substances, is to fire them in such a way that their expansion shall indent a block of some soft metal, such as lead or copper, either placed in contact with the explosive, or receiving the impression through the medium of a piston. In tests requiring accurate determinations, the soft metal is employed in the form of a cylinder of a certain length, which, under the impact of the piston driven by the explosion, is shortened, to an extent that can be measured by means of micrometer guages, and on comparing the effect with that produced by the action upon similar cylinders of known forces of a different kind, a good idea can be obtained of the forces developed by the detonation. In the experiments at Hallett's Point, which were undertaken with special reference to the torpedo-service of the United States, the ordinary measurements of the explosive force of various substances were supplemented by investigations into their effect, when fixed under water, upon submerged objects near by. The apparatus used for making determinations of this sort, as described in the *Engineering News*, was very simple and effective. An iron buoy, made very strong, to resist the explosion of the experimental charges, was furnished with a wire rope, of adjustable length, for suspending the cartridges at the desired depth in the water. The rope was attached to the buoy by a link, sliding on a spindle, five rubber rings being interposed between the link and the nut on the end of the spindle, to act as a spring for preventing the full transmission of the concussion to the buoy. The cartridges to be fired were fixed by wires in the centre of a very strong iron ring, several feet in diameter, around the circumference of which were set six pressure guages, in sockets made for the purpose. The cartridges were fired by means of an electric spark from the shore, and after each discharge the ring was raised to the surface, the guages inspected, and notes made of the result. As the essential point of torpedo action is to produce an impression through the medium of the water upon floating objects, it is obviously of the greatest importance to know just what effect will be produced at a given distance by a certain charge of any explosive, and General Abbot's tests, conducted, as they have been, with extraordinary skill and ingenuity, have given the United States torpedo-service the reputation of being the first in the world in scientific understanding of the subject. As incidents in the investigations, many curious notes have been made. Those who have trolled in vain for blue-fish in Newport harbor know well enough that fish dislike the vicinity of a torpedo-station, but the Government tests show that the shock which affects them is transmitted through the water to a great distance, the explosion of a five-pound dynamite cartridge making menhaden several hundred yards away jump out of the water. It is possible that the concussion acts unpleasantly upon the delicate membranes of the gills and swimming bladder, in something the same way that the striking of two stones together under water by a mischievous boy will cause severe pains in the ears of his fellows who may be diving or swimming below the surface in the vicinity, and the detonation of the high explosives would in this way be much more distressing than the comparatively slow combustion of gunpowder. The effect visible on the surface of the explosion of a torpedo is found to depend greatly on the depth to which it is submerged at the moment of firing. A charge of one hundred pounds of good dynamite, fired at a depth of five feet, will throw up a column of water three hundred and forty feet high, and about thirty-five feet in diameter, while two hundred pounds, at a depth of nineteen feet, will throw a column eighty feet in diameter to a height of only eighty-one feet.

A NEW telephone, according to the *Revue Industrielle*, has been introduced by Dr. Ochorowicz. The main point of novelty seems to consist in the magnet, which is in the form of a split tube, and is furnished with a vibrating plate at each end. The two plates are polarized alike, so that when the magnet, under the influence of the current, attracts one, it repels at the same time the other, and the vibrations reinforce each other. The bottom of the box containing the magnet is also made of a plate of tin, fixed at the centre, and serving apparently as a sort of sounding-board; and the effect of the united action of the plates is to increase the efficiency of the instrument in a very marked degree. It is said for instance, that music can be transmitted so as to be heard all over the room in which the telephone stands, and conversation can be distinctly heard several feet away.

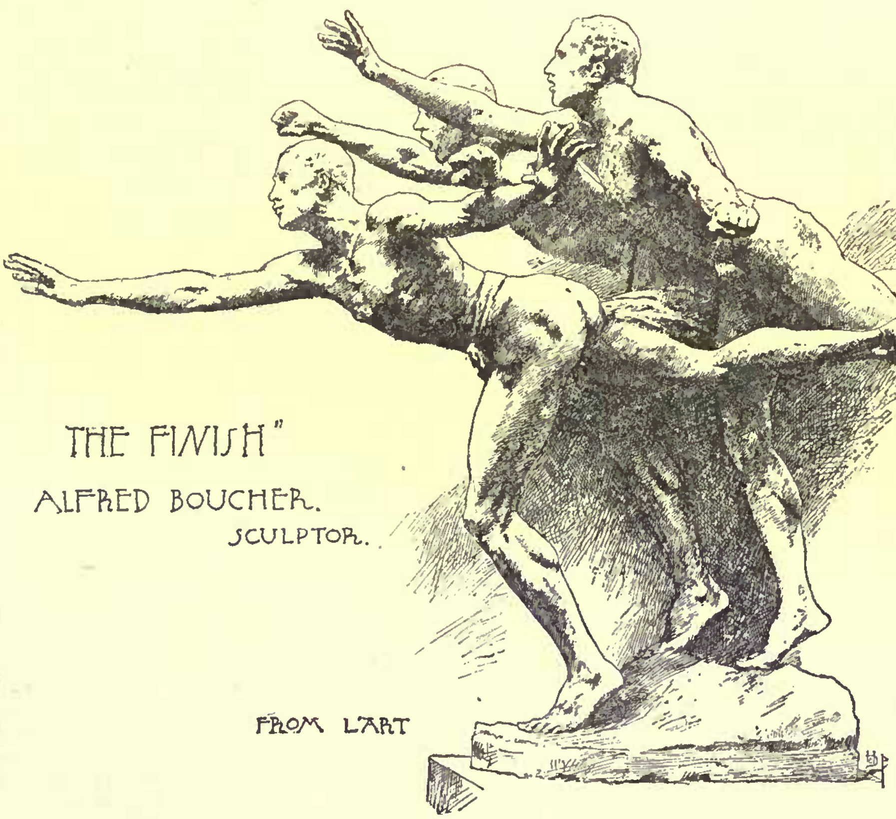
NOTES OF TRAVEL.[1]

TOLEDO.



From the Hospital of Santa Cruz.

Toledo has been styled not improperly the Faubourg St. Germain of Spain; the city of old memories, with its dingy, weather-beaten aristocracy; its splendid memories of the past and its tattered rags of modern decay; its relics of vast industries and its shiftless hand-to-mouth habits of to-day; a city wherein the Darwinian theory has been reversed and the fittest in everything, art, science and society, has been slowly dying off through two centuries, while the worthless has thriven among the ruins and taken the first places in what was once the proudest city in Spain. The tale of its ups and downs would fill a volume. The Romans found it a thriving centre of population. Leovigilde, the Visigoth, made it his capital, raised it above the other cities of the peninsular in rights and powers, and renewed it on every side. In 711 the Moors invaded the land, and of the many kingdoms into which Spain was divided by them, Toledo was, for a long time, the foremost. In 1085 the Castillians came over the mountains, drove back the Moors towards Cordova, named the whole country New Castile, and for more than three centuries Toledo was the first capital of Christian Spain, with a population exceeding 200,000, and a vitality in art and industry that is hard to appreciate now. With the establishment of Madrid as the capital of united Spain, Toledo began to die the slow death which has been lasting these three hundred years.



With such a history, no wonder that Toledo is rich in monuments, nor is one surprised to find Romanesque and Moorish, early Renaissance and late Gothic, all mingled together within its walls. Toledo is the centre of Spain, architecturally as well as geographically. From North and South its architecture has been drawn, and fortunately each period did not blot out all the works of its predecessors, so that in seeing Toledo a fair idea can be formed of all the styles which have flourished at different times and in different portions of the peninsular. And there is plenty of good work from each period, though a great deal of it is so hidden away in unexpected ways that the city at first does not promise any of the riches which closer acquaintance reveals. It is a field for the patient investigator, for one who is not daunted in his architectural burrowings by the forbidding glare of the omnipresent Spanish whitewash. Foreigners, somehow, have a notion that the Spaniards are a very dirty people, but to judge by the way in which they whitewash every wall and ceiling showing the slightest leanings towards antiquity, one can hardly accuse them of being architecturally unclean.

Toledo is built on a high, precipitous bluff — the inhabitants declare there are seven hills, and compare them to those of the Eternal City. Around three sides of the bluff runs the Tagus in the curve of a wide Moorish arch — a turbid, rushing stream, too hemmed in by the rocks to do anything but fret and foam and make navigation dangerous. In order rightly to appreciate the extremely picturesque situation of Toledo one ought to arrive at the railway station after dark when the moon is just rising over the distant hills, and, leaving baggage and all cares to follow by omnibus, make the ascent on foot. It is a good half-hour tramp to the plaza, but it is well worth the effort. The road crosses the river by an old Moorish bridge with a monumental archway at either end, and then turns sharply to the right to wind slowly along the steep sides of the cliff. Far above, the square walls of the Alcazar and the few remains of the Castillian fortifications stand out against the moonlight in picturesque silhouettes, and at every turn some new, dim perspective offers itself; a huge jutting parapet, apparently hanging over the edge of the bluff; a lowly, massive brick pile pierced with a wide horseshoe arch; a slender tower rising above a confused tangle of roofs; or a flying-buttress and an angle of a Gothic church; while on the right, as one ascends, the twinkling lights of the few dwellings in the valley seem to stretch out farther and farther towards the darkness of the hills, and one can hear the river roaring and breaking in vague white bands as it dashes over the rocks and under the black shadow of the old bridge. And after winding half way around the city and crossing back on itself the road ends in the quaint Plaza de la Constitucion, lined about with open colonnades and full of mysterious shadows and picturesque outlines. All this looks quite different in bright sunshine, for, however interesting the forms may be, Toledo lacks color, or rather has but one color, a pale brown or yellow, which is repeated in everything, stone, rocks, the mud houses, the pavements, the distant hills, and even the swift-flowing river, so that only under the questioning obscurity of early moonlight does one fully realize the beauty of the situation.

The architectural history of Toledo may almost be divided into two epochs: the brick period and the stone period, the former ending with the expulsion of the Moors and the introduction of Castillian ideas, and the latter reaching down to the time when the city became too poor to build any monuments and contented itself with mud and stone for its private architecture. The Moorish brickwork of Toledo deserves more careful study than it is apt to receive, as it is almost unique of its kind; indeed, excepting the Giralda at Seville and the tower of San Juan at Saragossa, there is hardly any Morisq work existing in Spain in which brick serves as any more than a mere surface to receive stucco ornamentation. In Toledo there are half a dozen or more Moorish towers, all of them graceful in proportions — the Moors never did an ungainly piece of work — and all of them designed in a way which shows that the use of brick was perfectly well understood, even if stucco was generally preferred for finish. Possibly, some of the work which now shows nothing but brick may have been once incrusted with a still richer ornamentation in stucco, though the appearances do not seem to indicate anything of the kind.

One of the most pleasing of these constructions is the tower now forming part of the church of San Tomé. It has been considerably mutilated by time and the Christians, the windows above and below

[1] Continued from page 96, No. 557.

have been partly filled up, and the columns of the light intermediate arcade have disappeared, but the main lines still remain. Who but a Moor would ever make a success of such a combination of plain, broad wall-surface and delicate cusped arches? Those old masters of Spain understood some things about architecture thoroughly. They were never mistaken in proportions, and they knew how to make a plain brick wall interesting by the use of a very little fanciful detail, and by employing the simplest possible features. Another no less interesting piece of Arab work is the old city gate, known as the Puerta del Sol, which is said to have been preserved intact as the Moors left it, though the masonry offers a suggestion of Castillian restorations. In the centre is a round horseshoe archway beneath a wider pointed arch springing from plain columns — a theft from some early Christian church, doubtless. Above is a double row of interlacing brick archings, such as the Moors used so often in their work; on the right a square bastion, against which the city wall abuts; on the left, a huge semicircular tower with an open gallery making the circuit and projecting outlooks on each face; the whole combined in a pleasing, harmonious manner and capped with a battlemented cornice; simple and solid as becomes its character of city gate, but with enough fancy to give it the æsthetic charm which seems inherent in all the handiwork of the Moors.

A building quite worthy of notice, Moorish only in the style of its architecture, is the old Jewish synagogue, built in 1366 by a wealthy Jew whose name has descended to us, Samuel Levi, and possessing an added attraction to the architect from the fact that it was the first instance in which the Jews made use of the Mauresque in the building of a synagogue, a style which has proved so acceptable to Jewish ideas that it has been generally adopted ever since. This old temple consists of a single nave with no chapels or niches, and plain walls unbroken save by the few narrow lancet windows and by a broad stucco frieze of the richest Moorish design. The ceiling is of wood, hipped all around, with traces here and there of gilding and color decoration and a few bits of elaborate carving. The Jews were driven out in 1492. Since then the synagogue has been known as the church of Neustra Señora del Transito, until within quite recent years, when the government has claimed it as an historic monument.

Another reminder of the Jewish period is the church of Santa Maria la Blanca, once a synagogue, successively a catholic church, a reformatory for women, a soldiers' barrack, an army store-house, and now in the hands of the Commission of Ancient Monuments, which has restored the elaborate detail with more or less success, applied whitewash freely, but rather indiscriminately and placed the mutilated remains under the charge of the government. In plan, this synagogue is essentially the same as a Moorish mosque; an oblong divided into five aisles by rows of piers and arches supporting a wooden ceiling which is level over each aisle but raised higher at the centre, somewhat after the manner of a Christian basilica. The architecture has suffered so that one can only speculate on the richness which once adorned it, but the few scattered bits of tiling and poorly restored ornaments can give an idea of what it might have been.

Leaving the Moorish work — for space would fail to notice even a tenth part of the remains of this style scattered about Toledo — the cathedral is the building of the stone period which claims the first attention, both from its size and the intrinsic merit of its architecture. The Spaniards have made the bishop of Toledo the primate of all Spain, and they fondly regard the cathedral as one of the wonders of the world, perhaps with more reason than would be at first suspected. The construction was begun in 1227, and extended through two centuries and a half. The style is Gothic, of singular purity when it is remembered to what vagaries Spanish Gothic sometimes descended. The façade is quite irregular. Three richly-ornamented portals occupy the width of the church. On the right is a high, octagonal cupola rising over one of the chapels, and on the left, symmetrically placed in elevation, but projected boldly from the façade, is the tower shown by the sketch, a lofty structure which starts from a plain basement, extended half the height of the church, the walls and square buttresses above being panelled and treated in a manner recalling the campanile of the Florence cathedral. The only windows in the tower are at the very top, just below the platform. The lantern is later and more florid in style. The octagonal spire is terminated by a series of globes and an iron cross, and is encircled by three bands of wood in the shape of crowns of horizontal rays, supposed to represent the crown of thorns — a curious idea and a curious effect which is not altogether bad. Each transept has an elaborate entrance, that on the north being peculiarly picturesque in arrangement and treatment, and so enclosed by tall, projecting buildings as to give most delightful half-glimpses as it is approached from the steep, narrow alleyway before it. None of these entrances are used, however, except on fête days, access generally being had to the cathedral through the cloisters at the north of the façade.[1]

To attempt a description of the interior of the cathedral would be wasted effort. The Spaniards, more than any other people, are prone to overcrowd their churches, to multiply riches to such a point that one is apt to retain only a confused idea of a blaze of gilding, a profusion of elaborate grille-work, rich, dark old canvasses, intricate vaulting, and general indefiniteness as to further detail. Besides, in Spain the church is primarily for the use of the priests, and three-quarters of the nave as well as all of the choir is enclosed by high screens, which while affording additional field for the efforts of the sculptor and decorator, and so adding to the richness of the interior, quite interfere with anything like general effect. Then, too, the stained-glass windows which form so important a feature of the northern interiors are reduced to a very small compass in Spain, and placed high in the walls, shedding only a subdued light in the church. The Toledo cathedral is not as obtrusive in the character of its internal architecture as most of the Spanish churches; but it has its full share of all the redundancy which is so perplexing when one tries to grasp the general scheme, and yet is so delightful when one does not care a fig which is the transept or how many aisles there are, but is willing to wander about from one rich bit to another, and enjoy the whole by taking in its parts. Later on, reflection, and a judicious reference to a guide-book will tell one that the cathedral is five-aisled, and has transepts, ambulatory, triforium and clerestory after the manner of all well-behaved cathedrals, and that it measures three hundred and seventy-three feet in total length, by one hundred and eighty-eight in width; but mere statistics or guide-book notes can give one very little idea of so thoroughly Spanish an interior as this. There are rich mosaics, curious old tombs, a chapel devoted to the Easter puppets and processional vessels, all ablaze with gems and precious metals; a triple range of choir stalls of which Théophile Gautier speaks as an "*œuvre effrayante de details;*" a couple of huge, bronze pulpits, half-a-dozen finely wrought-iron grilles; colossal organs hanging over the choir stalls; a sacristy packed with tier after tier of richly-embroidered vestments; a baptismal font six hundred years old, and a thousand other attractions — far more than any one mortal can ever hope to comprehend.

The Church of San Juan de los Reyes is the most pretentious edifice of Toledo after the cathedral. Erected in 1477 by Ferdinand and Isabella in commemoration of their victory over the Portuguese at Toro, it was destined as a place of royal sepulture and was greatly enriched by the Catholic sovereigns, though ultimately neither of them was buried there. The style of the church is very late Gothic or early Renaissance of a type whose principal attraction is in the infinite amount of work expended rather than in any intrinsic beauty of idea or design. Some parts of the interior, a broad, single-aisled nave, are not bad, however. The piers are covered with richly-carved arabesques; an elaborate gallery in stone extends all around the church; and each end of the space corresponding to a transept is covered with ornamentation: below, rich, pointed arches; above, a gallery divided by columns into niches for statues, hung with the emblems of Castile and Arragon, and adorned with the interlaced initials of Ferdinand and Isabella. Adjoining the church is a fine old cloister, said to be the best existing example of the Spanish Gothic.[2] When the Moors were driven out of Spain, Ferdinand and Isabella presented to this church the heavy iron chains of the Christian captives delivered at Malaga. These chains are still preserved, and are hung about the exterior of the choir in a manner which adds not a little to the effect.

Of the Renaissance period, Toledo possesses a great variety of examples in all shades of style, from such early work as illustrated by the court of the Hospicio, with its short, heavy columns and curiously bracketed imposts, to the light, well-proportioned work represented by the court of the Alcazar, where the imperial eagles figure in the spandrels to show that Charles V once ruled in Toledo. More interesting than either is the ancient hospital of Santa Cruz, erected towards the close of the fifteenth century, a fine example of what the Spanish architects designate as the Plateresque — the style of the silversmiths; a style which is sometimes pretty bad, and is apt to be rather hap-hazard in its proportions, and uncertain in its quality, though generally abounding in those delicate, sharply-cut details and effective arrangements of high lights and shadows which are so satisfactory when executed in silver on a cup or a salver, and are at the least interesting when rendered on a larger scale in stone, as in the present instance. One good feature of this class of work is that the figures, which are used so freely in relief and in the round, are always well executed, besides fitting nicely into the general scheme. The Plateresque is about as near as the Spaniards have ever come to developing a style of their own. Truly it is only a degenerate, or perhaps more precisely an undeveloped early Renaissance, and corresponds exactly to what the same period produced in England, France and Germany; but the Spaniards added a whimsical, playful treatment which no northern nation would have thought of, and they so introduced fanciful iron grilles at the windows, curious wrought knockers at the doors, and bold, expressive figure carvings in unexpected niches and reliefs, that however hard it may be to define, the Plateresque style is full of individuality and quite different in character from either Elizabethan or Francis I.

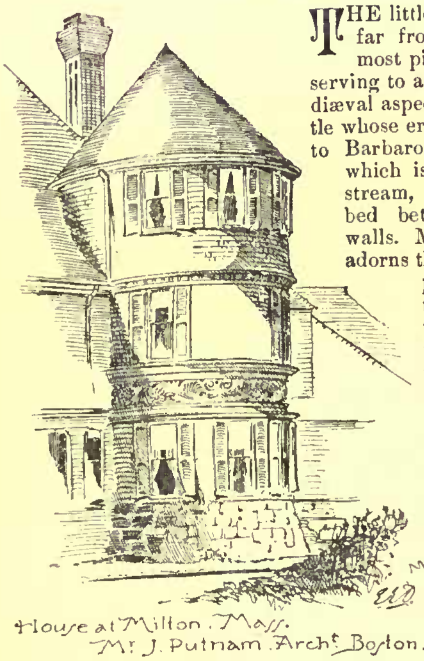
We are told that a year would no more than suffice to become thoroughly acquainted with Toledo. A few days stay will speedily convince the traveller of how much there is to study in this strange confusion of narrow, crooked streets, wherein so many different styles of architecture are piled pell-mell over Moorish or even Roman foundations. On every side are reminders of decayed nobility and poverty-stricken municipality; and the street is poor indeed, which has not at least one wide-arched portal with massive oak doors, bound with iron, surmounted by a battered coat-of-arms, and studded over with the great, round nail-heads which the local diction designates as *medias naranjes* — half oranges. Toledo alone is well worth the fatiguing journey through Spain. It should be taken first, however, in order rightly to enjoy it; taken while everything Spanish is

[1] A view taken in the cloisters of the Toledo cathedral was published in the *American Architect* of October 4, 1884.

[2] For a view of this cloister see *American Architect*, No. 456.

new to one, and the senses are keenly alive to all the strange things which are found everywhere in Spain. Later, the very quantity of the attractions in the old imperial city would be sufficient to daunt any but the most indefatigable student. C. H. BLACKALL.

ART IN ALSACE AND LORRAINE.[1] — III.



THE little town of Kayserberg not far from Colmar is one of the most picturesque in Alsace, preserving to an unusual degree its mediæval aspect. The donjon of a castle whose erection is locally attributed to Barbarossa dominates the town which is traversed by a lively stream, tumbling over its rocky bed between ancient confining walls. Much interesting sculpture adorns the parish church, certain parts of which date back to the twelfth century. The town-hall is a pretty Renaissance structure with a rich wood-carving in its interior; and several ancient churches and chapels in the neighborhood deserve the tourist's attention.

Mulhouse, on the other hand, shows few architectural remains of an early date, its importance being commercial and comparatively modern. Its most interesting structure is the town-hall built in 1551 with polychromatic exterior decorations and a roof of red and green tiles. But the local historical collection — devoted entirely to the antiquities of the town and its immediate neighborhood — is singularly well planned and very rich in many departments. And not far away is the village of Ottmarsheim with a little church which is attributed to the Carlovingian epoch. In plan it is an octagon, the central-domed space being surrounded by massive piers bearing great arches of a single order, square in section, and wholly without ornament. Between each pair of piers is an arcade, rising to the springing of the arch, and supported by two slender columns with plain cushion-capitals; and above, unconnected by any secondary arches, but with their capitals rising to the crown of the great arch itself, are two smaller columns forming a kind of simulative triforium. One cannot but be interested to trace, in spite of many variations, the same idea which was sometime worked out by later and far distant builders — as, for instance, in the late Norman nave and choir of Oxford Cathedral.

The Church of Thann is more familiar to the student of books, and less exceptional in interest — a charming, tall slender structure, dating from the thirteenth and the two succeeding centuries, with a lofty tower and spire attached to its northern flank, and very elaborate late-Gothic portals.

The parish church at Guebwiller is in the transitional style of the twelfth century, with the round arch still dominant; the Dominican church of the same town is of the thirteenth century and contains remains of contemporary mural paintings; and not far distant is the Abbey of Murbach whose lords were once princes of the empire, and could boast of the name of Charlemagne upon their roll. The nave of the abbey church and its spire have been destroyed, but the choir and two square Romanesque towers, rising three stages above the roof, still survive. In the same neighborhood, again, is the village of Lautenbach, where the church is remarkable for a large and extremely elaborate porch of thirteenth-century origin. It is three bays in breadth, and two in depth, and covered with curious and interesting sculpture. In short, there seems to be scarce a village in the whole province of Alsace where the ecclesiastic art of the Middle Ages has not left relics that are always of interest, often of great antiquity, and not infrequently of unique character; and scarce a hill that is not crowned by the picturesque remains of civic and military building.

Turning now to the sister province, we may glance first at that City of Metz which has played so large in part in the active history of Europe, and is so identified in our mind with things political and military that we may feel, perhaps, as though nothing more artistic than fortifications could await us there. But in truth it contains much that is of the highest architectural interest, beginning with the large and beautiful cathedral. A church of the Carlovingian epoch had succeeded on this site a still earlier chapel, but was destroyed in the twelfth century. Reconstruction was immediately begun, but slowly and with many mutations of plan and design. Not until the middle of the fourteenth century was the structure given its present shape, and many parts are of still later date — the tower and the choir being of the end of the fifteenth century and the façade Renaissance in style. French fourteenth-century fashions show in the extreme elevation of the church — which with a length of three hundred and eighty feet has the height of one hundred and thirty-five; in the beautiful geometrical design of the immense windows, and in the general slenderness of all interior features. But the plan is German rather than French, the five-sided apse being without aisle or chapels. It is such facts as these, of course, which give the buildings of these provinces their peculiar interest; and it is singular, as I have already said, to see how wholly blind is the author now under review to their existence. The cathedral was once very richly decorated and furnished, but late Renaissance and modern vandalism has denuded it of almost all its treasures. The great rose-window, however, still keeps its fourteenth-century glass and those of the choir theirs of the sixteenth. The font is interesting as having been made out of an ancient Roman porphyry bath, and the episcopal throne as having been re-worked from portions of antique columns.

The Church of St. Vincent in Metz is not mentioned by our author, but is an interesting structure, with parts of every epoch from early Romanesque to late Renaissance. It was intended that a pair of towers should flank the choir — an arrangement which was quite common in this district.

The local museum of painting was founded only in 1839, but contains some good Dutch pictures and among its modern works Corot's beautiful idyl called "The Shepherd," famous as having been the first of his works to be sold, and the first to be engraved. The archæological museum includes a number of Græco-Etruscan relics from the old Campana collection and many objects of Gallo-Roman origin. The country round about Metz is full of traces of the Roman dominion, most striking among which is the aqueduct of Jouy. Of the long arcade which once crossed the Moselle there remain five piers on one side of the river, and seventeen with their arches on the other. The portion which actually spanned the stream seems to have been carried away by the water at a very early date, for a writer of the tenth century speaks of it as having perished long ere his day. According to some archæologists, Drusus was the builder of this aqueduct.

A very different town from Metz is Nancy. Few European cities wear so great a unity of aspect, its ancient estate having been wholly transformed in the last century and modern hands having added little since. An ancient walled town when Stanislas, last Duke of Lorraine, ascended the throne, it was turned by him into the very type of eighteenth-century civic elegance; and as such it still survives. It streets are straight and similar; its gateways so large and fine that, to quote our author they look like "veritable triumphal arches;" and its main square, formerly called the Place Royale but now the Place Stanislas, is all but unequalled in Europe for harmony and stateliness of design and charm of decoration. In plan it is a large rectangle (as usual, M. Ménard gives no figures) with cut-off corners. On one of its sides stands a large triumphal arch; opposite to this the great Hôtel de Ville; and rows of stately dwellings complete the circuit in uniform design — Corinthian pilasters rising through two stories above the basement and the windows they divide being adorned with balconies. The architect who thus remodelled the town for Duke Stanislas was Emanuel Héré, son of a local physician and evidently an artist of scholarly training, great vigor and excellent taste. But fine as is his work, it interests us less than does that of one of his collaborators — Jean Lemour, the famous iron-worker. The entire city is full of his products. Gates protect the entrance from the various streets into the Place Stanislas; brackets for lights project from the encircling houses; the many balconies just referred to have elaborate iron screens; the great staircase of the town-hall is similarly protected and the chapels of the cathedral enclosed in the same manner; the neighboring Château of Commercy boasts a splendid gateway, and many lesser dwellings in the various streets show minor trophies. All this wealth of delicately, beautifully, and variously wrought metal came from the workshop of Lemour, and yet his masterpieces still remain unnoted — the magnificent *grilles* which stretch across two corners of the Place Stanislas and connect the town-hall with the buildings on either hand. Our author does not give their length, but he notes that in their highest portions they rise thirty-eight feet and from his illustration we may guess at some fifty feet of extension for each, covering a quarter-circle on plan. Each is so designed as to form three portals (the central much the largest) which, however, are not true gateways but frames or settings for fountains. These fountains, designed with the rock-like substructures and basins and the groups of mythologic, aquatic figures so characteristic of the Rococo period, were the work of two local sculptors — Guibal and his pupil Cyfflé — and are singularly graceful, charming, and unexaggerated examples of their kind. Taking the conception as a whole — the stately palaces, the magnificently elaborate iron-work with its touches of gilding, the florid and animated groups, the spouting streams (we may suppose they *do* spout) and the background of thick foliage against which the harmoniously united stone and metal work is relieved — we have a most noteworthy example of that accord in idea and execution between artists in different branches from which alone can spring the finest architectural results. And we have a proof, moreover, that however the art of the time of Louis Quinze may have lacked for purity and depth and feeling, and for that highest beauty which depends upon these, it stands almost without a rival in the work of what I may call scenic decoration.

[1] *L'Art en Alsace et Lorraine.* Par René Ménard. Paris: Librairie de *L'Art;* Charles Delegrave. Continued from page 169, No. 563.

Lemour's iron-work deserves attention for its own sake, moreover, as well as for its effectiveness as a factor in Héré's scheme. His personality is made known to us through a large volume containing reproductions of his works from his own drawings, and a voluminous text which not only tells, in truly epic style of the perfection of his results and the difficulties which attended their production, but also traces in a delightfully naïve and imaginative way the history of the forger's craft from the days of Tubal Cain, and enthusiastically vaunts its practical and artistic importance. We may be amused at times by the exaggeration of his phrases and the egotism of his point of view; but the general result left upon our minds is that of admiration for one who was so confessedly and contentedly an artisan yet so thoroughly an artist, and was so passionately devoted to his own branch of work that he could not help seeing others in a somewhat distorted perspective. It is not philosophical criticism we want from an artist but contagious enthusiasm; not a just estimate of the comparative value of the medium he works in but such an appreciation of it as shall open our eyes to its highest worth and possibilities; and these are the things we find in Lemour's pages.

His designs, considered from a scenic, decorative point of view, are, as I have said, extremely admirable; and from a purely artistic point of view they have great charm and beauty — the general conception being dignified, harmonious, well-proportioned and well-balanced, and the supple, graceful Rococo details being treated with marvellous dexterity, originality and freshness of feeling. No one ever understood better than he that great principle of decoration which is so seldom mastered to-day — and nowhere more seldom than in work of the same character as his — the art of so covering the field that it shall be neither empty nor over-crowded, and of preserving throughout all mutations of detail the same general balance between motive and background. No Rococo ironwork is better than Lemour's — I think even the famous gateways at Würzburg are not so good, being less refined in feeling, less reticent in design, and heavier and more exaggerated in detail. But even the best Rococo ironwork — beautiful, seductive though it is, is not thoroughly "good" if examined from the point of view of the properties of the material and the exigencies of its manufacture. If we look at the illustrations in M. Ménard's volume — at least at such of them as are mere outline elevations — we might hardly guess that they represented wrought-metal work at all. That is to say, like all other products of the period, Lemour's *grilles* are architecturally conceived in imitation of structures built up of hewn materials. His great gateways stand on high solid plinths, with elaborate mouldings carefully profiled as though the chisel had been at work. From these rise lofty pilasters bearing arches and rich entablatures crowned with vases and trophies imitative of solid forms. Of course the whole structure is open, the main, forming members being united by lace-like tracery simulating sculpture in relief. And of course the design, though inspired by designs for stone, has been modified to suit the material and is executed with minor forms and details possible of realization in no other substance. But this does not do away with the fact that it *was* inspired by designs for stone — that the whole scheme is, from a true ironworker's point of view, a wrong scheme, proceeding from the desire to do something else than the most natural and straightforward work of which the material was capable.

Lemour himself dwells constantly and in the strongest terms upon the difficulty of his tasks — tells us how extraordinarily hard it is to hammer and weld his metal into such lithic shapes, what time, and patience, and accuracy of hand and eye go to the drawing of such accurate, strong, straight lines, the building-up of such elaborate architectural forms, the uniting into a single frame of such solid factors as form the basis of his designs. It was all honest smith's work he put into his products — all hammered, and welded wherever possible (nay, where one might have thought it quite impossible), and elsewhere firmly riveted — never cast or moulded. And the more one studies the non-metallic character of his conceptions, the greater grows one's admiration for the skill which could execute them thus as well as for the inventiveness and good taste which could imagine them so charmingly. But all the same, I say, it was in a certain sense mistaken taste and misapplied skill; and his own proclamation of the difficulties over which he triumphed does but prove the fact. A smith of an elder day would have found cause for glory in submitting to the natural requirements of his material; in drawing from *these* the beauty of his results; and in pointing out how essentially appropriate to travail of the fire and hammer were his lines and forms — not how difficult because *inappropriate*.

All of which things it is well to remind ourselves of just now, since our own use of iron is just beginning to assume the station and to have the ambitions of an art; for nothing is more seductive to the unreflecting eye than Rococo ironwork, and no books are more easily misleading to the novice than such as Lemour's. But having thus done what I conceive to be my duty, I will frankly confess that this is one of those cases we sometimes meet with in our study of art when, in spite of a knowledge of what is "good" and what is evil, and a willingness to accept the theories thereupon dependent as guides for practice, one cannot help almost preferring the evil to the good when one actually sees it. It has been my good fortune to study much ironwork of many epochs in many lands. Much of it is certainly more rational, some of it is certainly more beautiful, than that of the Rococo epoch; but none is so splendid, so triumphant, so superb, so imposing. And there are certain moods in which even the greatest purist among us prefers splendor to purity and grandeur to beauty itself. In such a mood we may perhaps confess that Lemour "ought not" to have used his metal as he did — but how glad we are that he *did!* There is a lawlessness which is a law unto itself — there are "illegitimate" results which do superbly well without any fathering from theoretic approval; and the splendid structures in iron of the Rococo epoch are among them. If I were not afraid of being accused of confounding small things with great and getting too much in the mood the artist of Nancy dwelt in himself (without the excuse which he had as an artist possessed by his art), I should say that we may consider such efforts somewhat in the way we consider the audacities of a Michael Angelo in paint. Theoretically they are not to be commended — of a surety they ought not to be imitated — yet how great a good fortune it is that they were executed!

The Hôtel de Ville at Nancy contains the museum of paintings, which is the richest in the provinces, possessing some excellent Italian pictures, a greater number of good examples of the Netherland schools, and certain admirable French pictures of the eighteenth century. These last, then a little out of fashion, were sent by the consular Government to decorate the Hôtel de Ville at the time of the Congress of Lunéville, and have never been returned to their original resting-place.

The ancient ducal palace of the city, famous for the splendid late Gothic portal that has so frequently been reproduced, contains the museum of antiquities which, however, was partly destroyed by fire soon after the entrance of the German army in 1871. Its greatest treasure was fortunately preserved — the splendid tapestries found in the tent of Charles the Bold after the battle of Nancy. They consist of seven immense pieces, covered with allegoric and historic figure-subjects and are the largest and finest of the kind in France.

Lunéville is another town which shows few remains of earlier than eighteenth-century date, though it is said to derive its name from the fact that Diana was worshipped there in Roman times, and though certain statues found in its soil seem to confirm the belief. Its finest building is the château, now used as a barrack, with a park that was once very famous but has been allowed to fall into great decay. St. Nicholas-du-Port has a late flamboyant-Gothic church, and Toul two churches of much interest. St. Stephen's, formerly the cathedral, is apparently of the thirteenth century (once more our author gives no date) and a peculiarly pure yet rich example of the time. Its beautiful glass still remains in part and its episcopal chair is a marvel of delicate sculpture. But in many details, and especially in its splendid west portal, it suffered greatly at the time of the Revolution. The Church of St. Gengould, in the same town, contains many interesting tombs and is also of a pure Gothic type with cloisters from the latest epoch of the style.

The church at Epinal goes back in part to the tenth century and in part is transitional. M. Ménard gives an illustration of its main portal which reveals a work of great beauty, and, considering its location, of some singularity. It is late but still pure Romanesque, and although very rich, bears no figure-sculpture whatever save a single figure of Christ in the tympanum. The arch is recessed in six orders, each supported by an attached column with a delicate foliated capital. The architraves themselves are square in section and enriched with chevrons, billets, Greek frets and similar motives which are far more Norman than southern in effect. As a piece of purely conventional decoration it is extremely interesting and admirable and, I repeat, unusual in a land where the figure-sculptor's chisel was so profuse of its products.

The Church of Bar-le-Duc and the Museum of St. Mihiel contain many sculptures attributed to the great local Renaissance artist, Ligier Richier, whom I have already mentioned. So great is the diversity between them, however, that we must believe the attributions in many cases erroneous. His work may well be acknowledged in a fine group of St. John supporting the Virgin which is all that remains of a vast competition once placed in the choir of the church of St. Mihiel. It is mediæval in feeling but shows the results of classic study in the beautiful arrangement of its draperies. But the same hand that wrought this can hardly have created certain other groups and figures whose aspect and accompanying architectural details speak of the seventeenth century.

M. G. van Rensselaer.

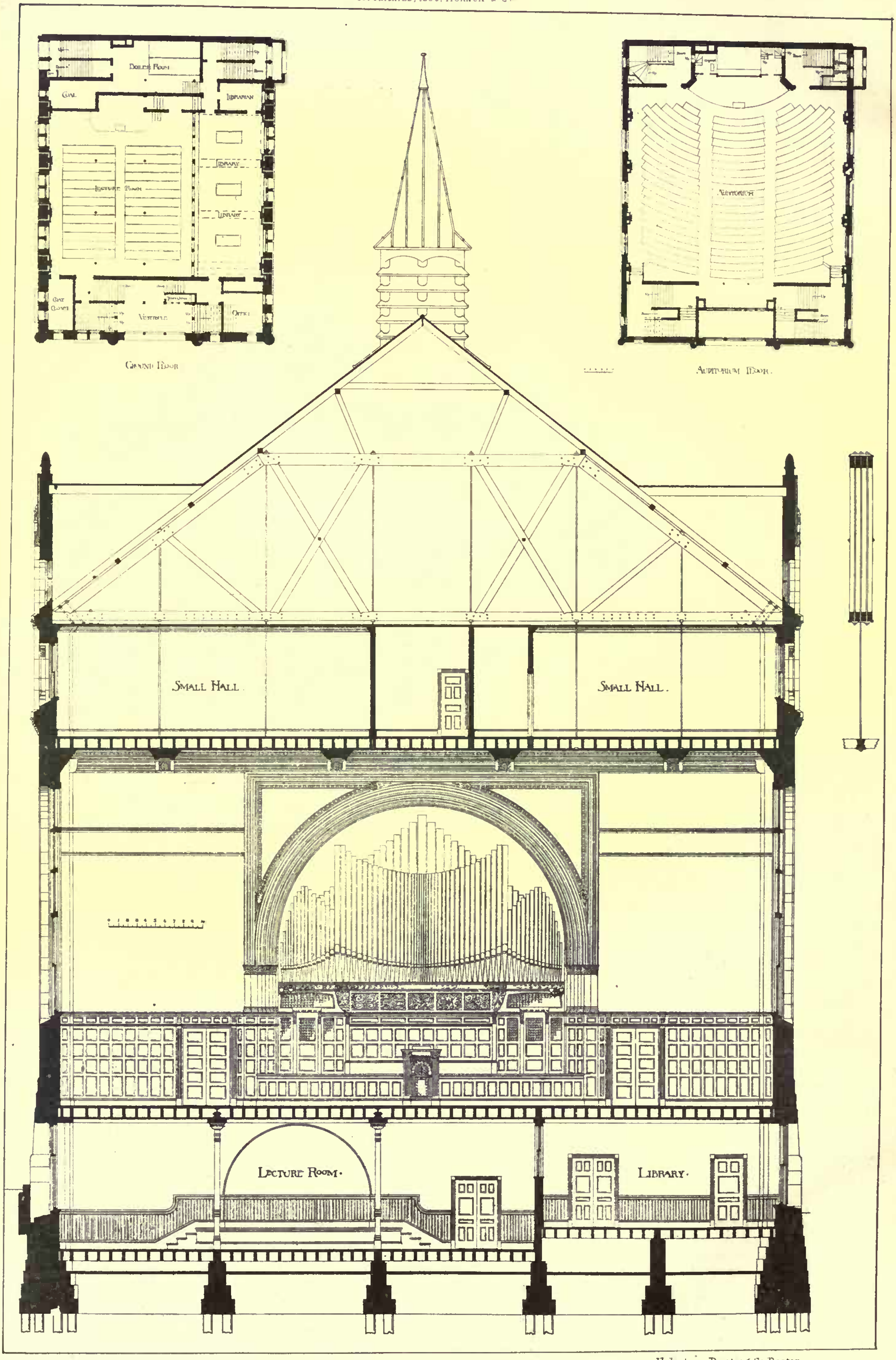
THE ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

THE FIRST SPIRITUAL TEMPLE, BOSTON, MASS. MESSRS. HARTWELL & RICHARDSON, ARCHITECTS, BOSTON, MASS.

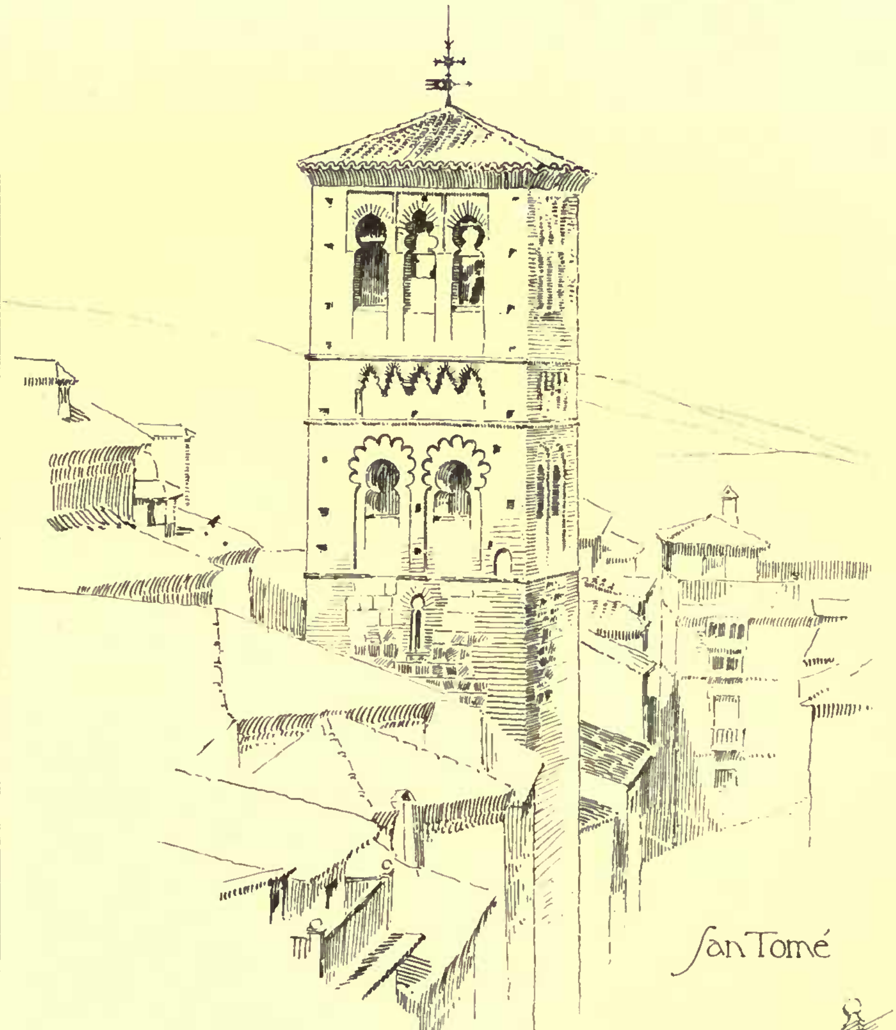
[Gelatine print issued only with the Imperial and Gelatine editions.]

THE First Spiritual Temple is situated at the corner of Exeter and Newbury Streets. The materials employed in the construction of the exterior are best Longmeadow freestone and Braggville granite. The basement contains a lecture-room, with seating capacity for five hundred, and a library and reading-room, as well as room for heating-apparatus. The principal story is occupied wholly

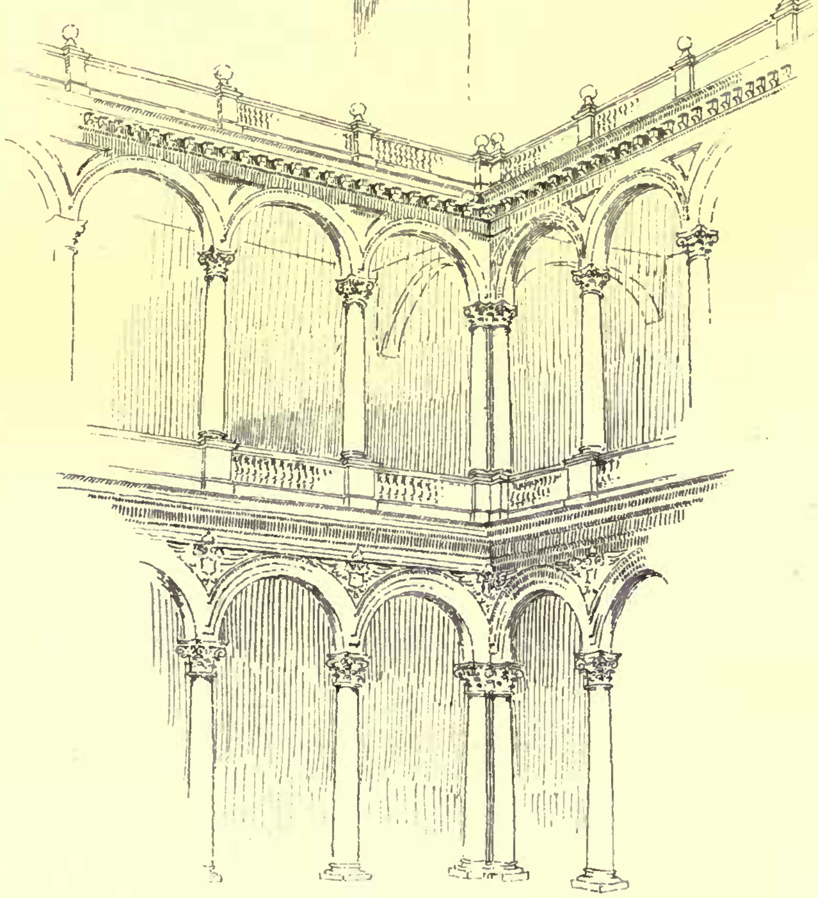


Heliotype Printing Co Boston

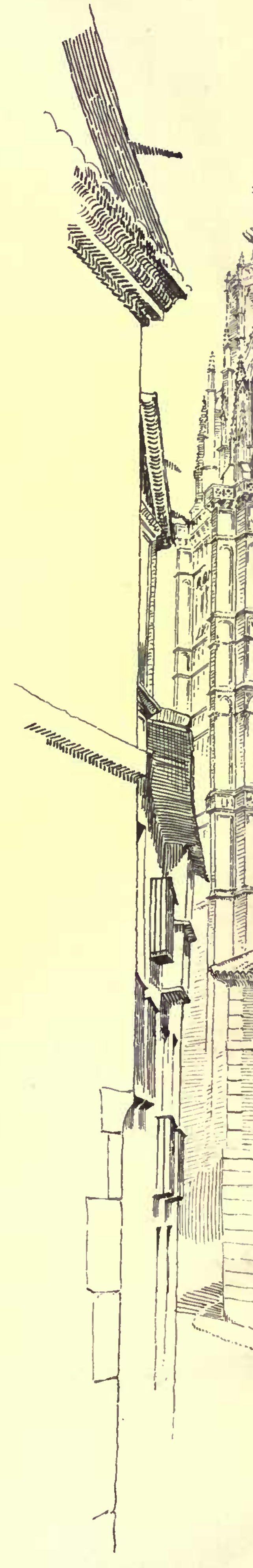
First Spiritual Temple ·· Boston ··



San Tomé

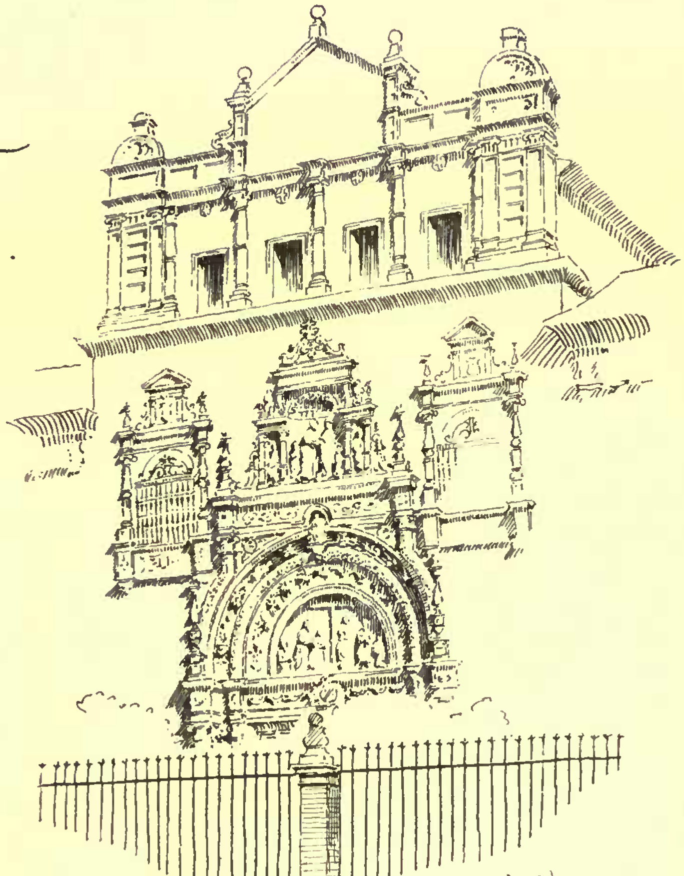


Court of the Alcazar

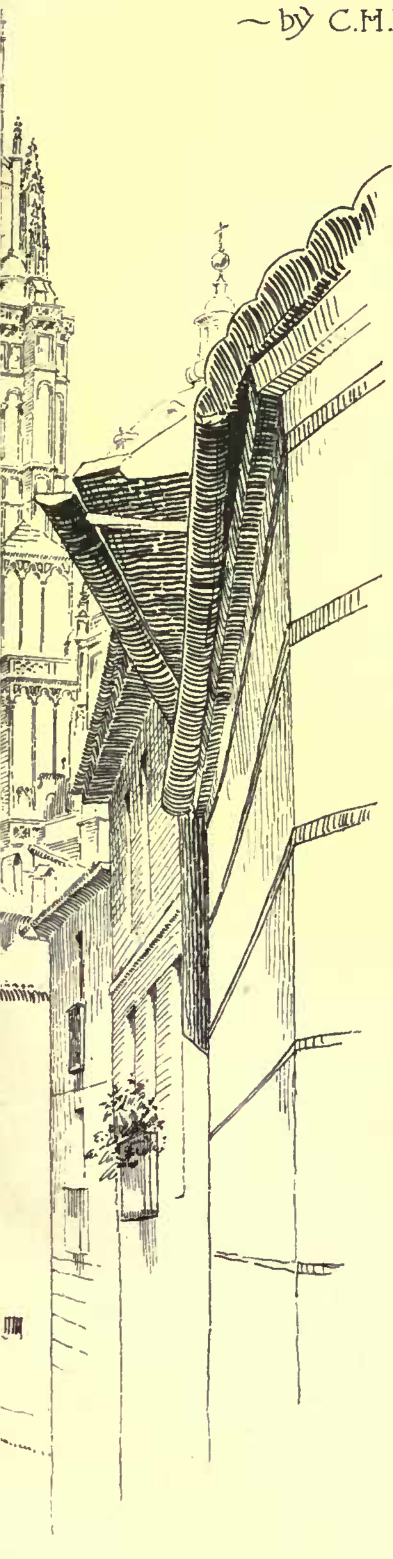


Sketches from ~TOLEDO~ ·SPAIN·

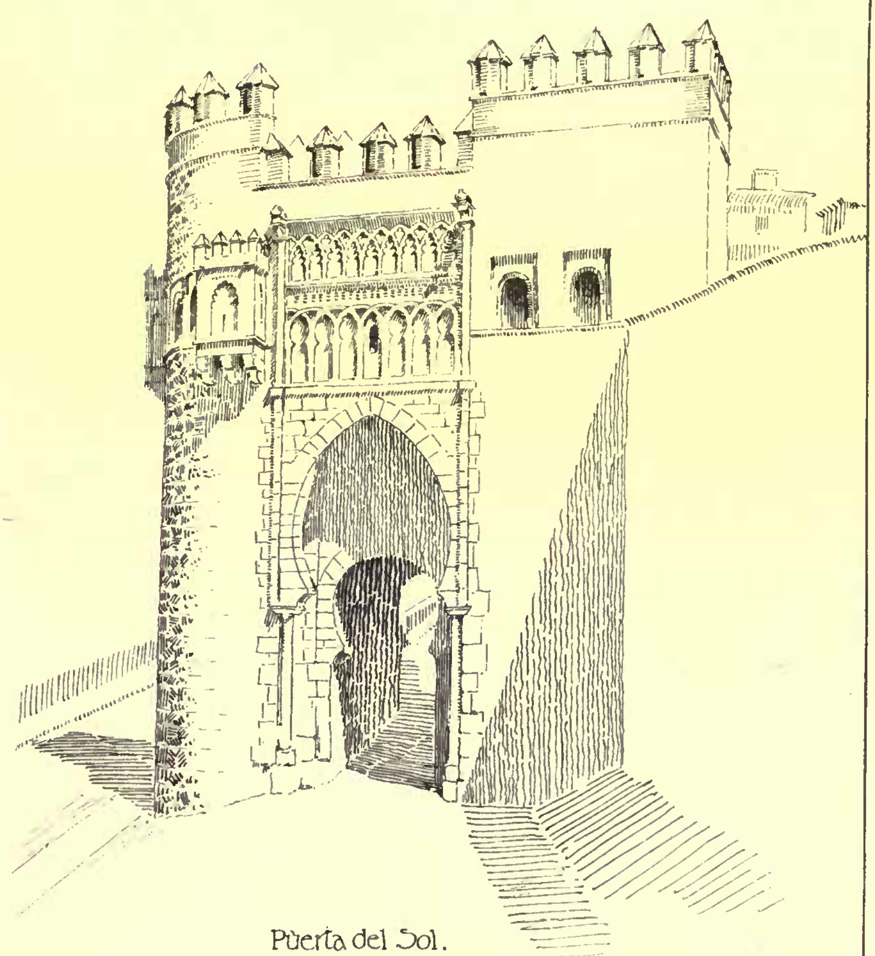
~ by C.H. Blackall. ~



Hospital of the Santa Cruz

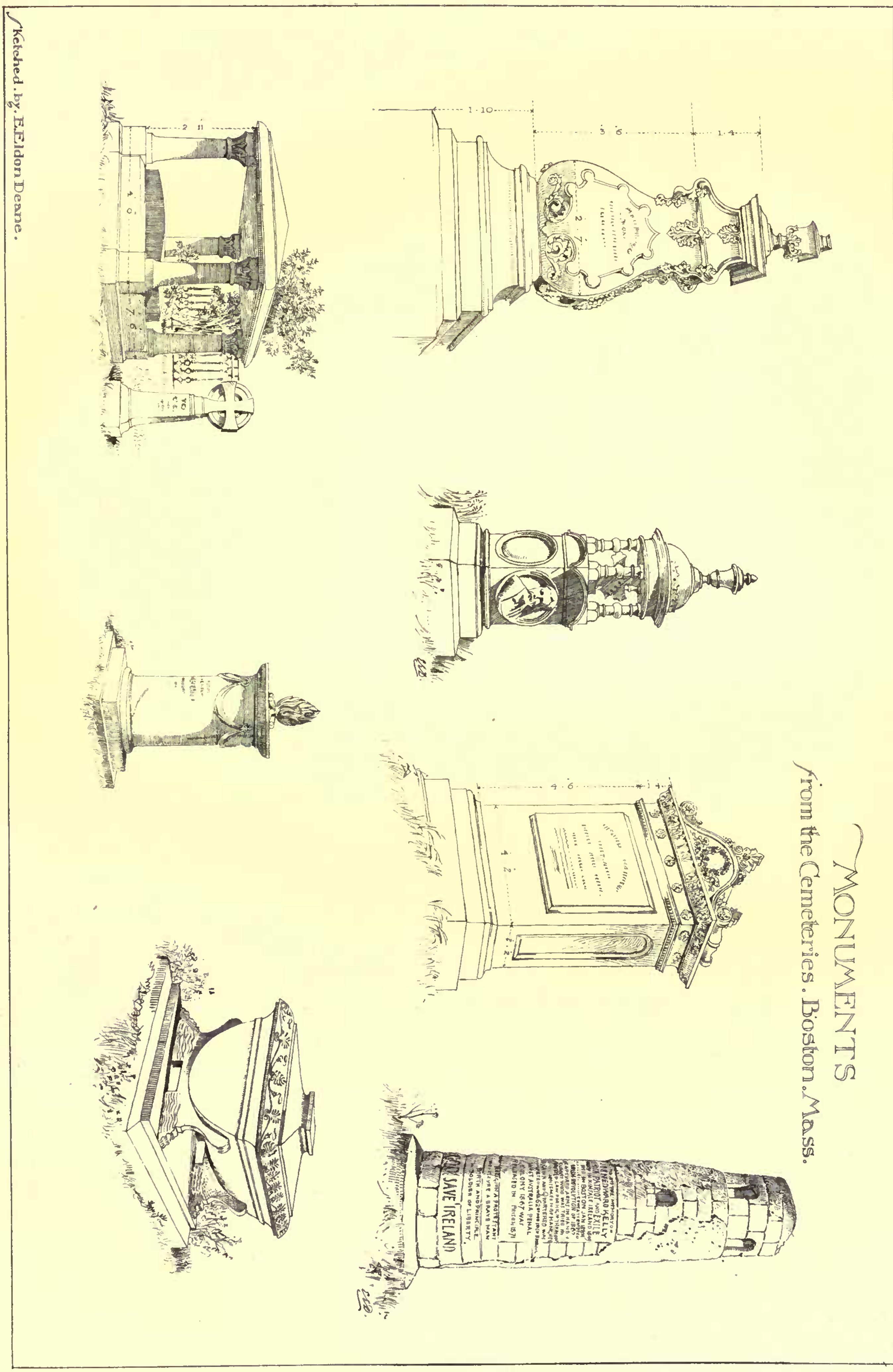


The Cathedral Tower



Puerta del Sol.

Heliotype Printing Co Boston

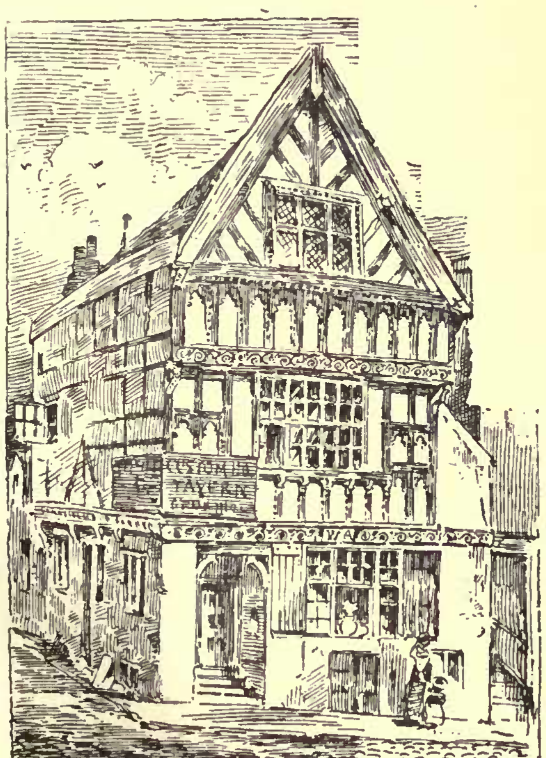

MONUMENTS
from the Cemeteries. Boston. Mass.
Sketched by E. Eldon Deane.
SAVE IRELAND



The Village School : Bromfield : Eng.^d from sketch by E. J. May . Arch.t Lond.



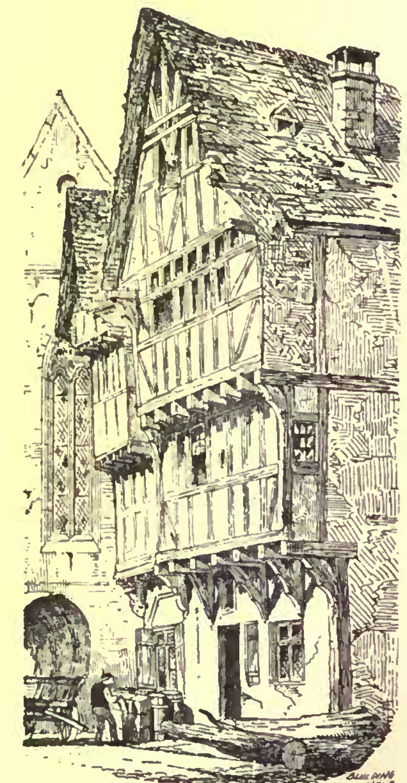
The Village School Bromfield. Eng.^d from sketch by E. J. May. Arch.t



AN OLD HOUSE AT CHESTER T. Raffles Davison del. from a sketch by B. J. Talbert



A House at Bacharach on the Rhine.



HALF TIMBERED HOUSES – BACHARACH PRUSSIA.

HALF-TIMBER WORK.

by the large hall, with gallery, organ-chamber and speakers' platform. Thirteen hundred persons can be seated. Over the hall, suspended from the roof-trusses, is a story of rooms of various sizes, from a lecture or class room, about 30′ x 40′, to rooms 18′ x 26′, all reached by staircases at each end of the building, with a central corridor connecting the two. The interior finish is of oak and of stained whitewood. The work has been very thoroughly done, at a cost of $138,266.61.

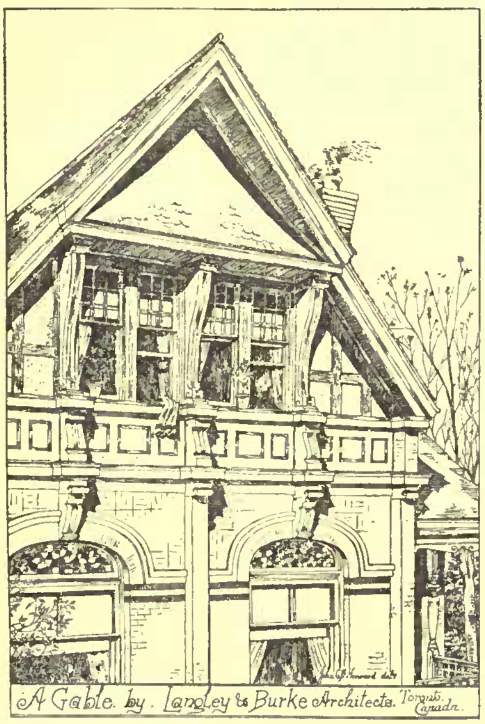
PLANS AND SECTIONS OF SAME.

TOMBSTONES IN CEMETERIES IN AND AROUND BOSTON.

SKETCHES AT TOLEDO, SPAIN. MR. C. H. BLACKALL, ARCHITECT, BOSTON, MASS.

FOR description see "Notes of Travel" elsewhere in this issue.

HENRI REGNAULT.[1]



THE tragic death of Regnault was in harmony with his life and temperament. Impulsive, enthusiastic and headstrong, he was ever inclined to rebel against authority: and so we find him throwing away a valuable life in a vain endeavor to injure the victorious enemy. The battle of Buzenval had been waging fiercely all day, and it was only from sheer necessity that the retreat was sounded. What could a handful of men, who had gone through continued privations during the siege do against an enemy many times more numerous, and, withal, better disciplined, better fed, and better commanded? And so, as evening drew on, it was thought wise to retire; but Regnault, instead of obeying immediately, cried out, "*Le temps de lâcher mon dernier coup de fusil, et je vous rejoins.*" He belonged to the new France. He possessed the revolutionary temperament, the rebellious spirit which is often a virtue in art and literature, but which is always a vice in a soldier — perhaps proof positive that highly-civilized beings are not fit to inhabit this nether world, where brute force and diplomacy, otherwise dishonesty, alone succeed and reign supreme. Regnault was in perpetual revolt against authority, either that of his father, or of the Institute, or of the world at large. He wished his "Judith" to be his first *envoi* from Rome, but the rules prescribed a study of the nude, and thus we find him in a letter complaining of this "*joug du réglement*" which he had such difficulty in bearing. Gifted with an indomitable will, and an enormous faculty for surmounting difficulties, he became an expert in swimming, walking, gymnastics, riding, and all manly sports, completely revolutionizing his physique, which, from being weakly and puny, developed into strength and agility. He delighted in danger of all kinds — from the time when, as a child, he entered a lioness's den, the better to sketch her, to the day when he foolishly braved the German bullets. Endowed with a passion for strong contrasts, we find his letters full of enthusiastic exaggerations about men and things; indeed, they are the most interesting part of M. Marx's book. His love of sunshine was as strong as his hatred of gloom and fog: without light he could not live. "If poets love winter," he writes, "and evenings spent by the fireside, we painters abhor all that is not bright and light—the beautiful sun and lovely heat, which enables us to work in shirt-sleeves and slippers. We cannot paint with our feet in a *chancelière*, we want freedom for our movements; we want a blue sky. Perhaps later on I may find a more equable climate than ours, where I shall always have the blue sky over my head." And, again, from Tangiers he writes, "God forgive me, but I cannot think that the sun which lights your part of the world is the same as ours; and I contemplate with terror the time when I shall have to look upon the dismal crowds and houses of Europe. But ere I depart I mean to make the real Moors live again. . . . Then to Tunis, then Egypt, then India! . . . I shall rise from enthusiasm to enthusiasm. I shall intoxicate myself with marvels until, completely *halluciné*, I shall be able to drop down into our sad and common-place world without fear of losing the light which my eyes have drank in during three or four years. Then, in Paris, when I want to see clearly, I shall only have to close my eyes, and visions of Moors, Tellahs, Hindoos, enchanted palaces full of gold and lapis, white marble elephants, and, in fact, all the East, will appear to me afresh. . . . *Ah! quelle ivresse, la lumière!*" Fate declared otherwise; and, instead of this beauteous vision, he was doomed to return to his native city to find her clad in misery, cold and suffering.

Towards the end of December he writes to his *fiancée* from the advanced post of Colombes, "At last, this interminable night is over! Ah, my poor friend, it is horrible! But I will not grumble, as many have suffered more than I. Three times during the day have we changed the camp. . . . An icy wind threatens each minute to carry off our tents; we are entirely exposed to this icy tempest; everything freezes in our saucepans; our feet become insensible. Oh! I can talk feelingly of the cold, and know what it is to pass a night upon the bare earth, exposed to a freezing blast. Four of our men were frozen, one of them a sergeant. . . . But enough upon this subject. I will warm myself at your fireside. *Je vous aime; j'aime mon pays, et cela me soutient. Adieu.*" Strange, he had a presentiment that he would die young; and it was this idea, doubtless, which made him take in everything with such avidity. "It is a characteristic of his nature," says Jules Claretie, "to be always pushing on: *En evant!* — go ahead, as the Americans say. What he had in his mind soon made him forget what he had just put upon his canvas. 'My brain must be upside-down, that I can never do things at the right time. . . . I live from day to day without thinking of the future. I want to gallop on horseback, to fly from one trapeze to another, and to paint *chefs d'œuvre*, all at the same moment.'" He worked indefatigably from morning till night. Artist by nature, he could use any medium equally well — oil, water-color, charcoal, lead-pencil, pen-and-ink. That he had the feeling of a poet is also seen in his letters from Grenada, which he describes as "*la plus belle des plus belles, la Grenade au ciel de lapis, aux tours et forteresses rosées,*" and the Alhambra as "*en or, argent, diament, enfin en tout ce qu'il y a de plus riche au monde.*" "*Tous les matins, nous allons dans la divine Alhambra, où les murs sont des dentelles d' améthystes et de roses le matin, de diament à midi, et d'or vert et de cuivre rouge au coucher du soleil. Nous restons là jusqu'à ce que la lune vienne nous voir, et, quand elle nous a envoyée quelques baisers et qu'elle a endormie les ombres des fées et des génies qui ont ciselés ce palais merveilleux, nous nous en allons à regret, nous retournent à chaque pas sans pouvoir arracher nos yeux de ces colonnes de marbre rose, qui prennent, par moment, les couleurs nacrées du corps satiné d'une déesse, et sont notre désespoir et notre bonheur tout à la fois. . . . Ma divine maitresse, l'Alhambra, m'appelle; elle m'a envoyé un de ses amants, le soleil, pour me prévenir qu'elle a fait sa toilette et que déjà elle est belle et prête à me reçevoir. Je ne peux faire autrement que de vous quitter.*" Again, from Marseilles, when he describes a little excursion by boat, "*ou la petite nacelle semblait fière d'être seule vivante et seule à fendre l'eau avec ce petit clapotis dont la musique est si agréable au milieu du silence.*" And, again, "*La lune s'était couchée, les côtes du fond se confondaient avec le ciel, on ne voyait rien que les étoiles et à l'extrême horizon deux ou trois lanternes qui faisaient comme une ligne brillante sur la mer polie comme une glace. On n'entendait pas autre chose que le soupir que rendait de loin en loin la mer en laissant mourir sur la sable sa dernière petite ride. . . .*"

The only qualities Regnault inherited from his father was his strong will, his perseverance and his energy. From the obscure position of an errand-boy, Regnault *père* rose to be Professor of Chemistry at the Collége de France, *directeur* of the Sèvres manufactory, and member of the Institute. A true man of science, there was little in common between father and son; indeed, there was more fear than love on the side of the younger man. When "Judith" was sent from Rome to Paris, Regnault wrote, "Do not show my picture to any one, *not even, especially not,* to my father." Sent, in 1854, at eleven years of age, to the Lycée Napoléon, he seems to have done well during his six years study, and, until he had passed his examination for the *bachelier ès-lettres,* his father would not let him have drawing-lessons — indeed, he seems to have done all he could to crush out his love of art. But all the boy's spare time was spent in drawing, at the *Jardin des plantes,* in the stables of St. Cloud, and in the Kennels at Meudon. His school books were covered with sketches of his friends, illustrations of the battles of history, and imaginary subjects from Greek mythology. In M. Marx's book is a re-production of a sketch done when he was twelve years of age, of some linesmen and a mounted officer, "Waiting for the Queen of England," which is full of character and discrimination. At fourteen he modelled one of the emperor's horses. His first lessons were some hints from Troyon (who also lived at Sèvres) and M. Montfort, a friend of the family, and a rather indifferent painter of Oriental subjects. Can it be possible that these two men, whose intercourse with Regnault was so slight, in any way influenced him in choice of subject? or did they simply help to develop his natural tastes?

When Henri left college, his father still persisted in stifling his son's enthusiasm by addressing himself to Ingres and Flandrin, neither of whom had time to devote to the boy's artistic education; but it was at their suggestion that he was confided to M. Lamothe

[1] "*Les artistes célèbres. Henri Regnault,* 1843-1871," par Roger Marx, Paris, J. Rouam, 29 Cité d'Antin. Broché, 4 fr.

and at the end of 1863 he entered the studio of M. Cabanel at the École des Beaux-Arts. The year before Regnault had failed in the *concours* for the Prix de Rome, but this year (1863), he tried again; but although his work was placed seventh or eighth by the judgment of his fellow-students, he failed through his innate rebellious spirit. "M. Lamothe no longer seems to interest himself in me, because last year after my failure, I set up at Sèvres instead of going back to the atelier where the light was detestable, and where I worked with less ardor than by myself, and at uncongenial subjects. At the same time I shall always have great affection for my good master, and shall ever feel grateful to him. . . . But for some time he has left me no liberty in my studies, and always wants me to paint what I do not see. I dare not discuss his narrow ideas with him, and I do not know how to do what I see, and yet not be disagreeable with him."

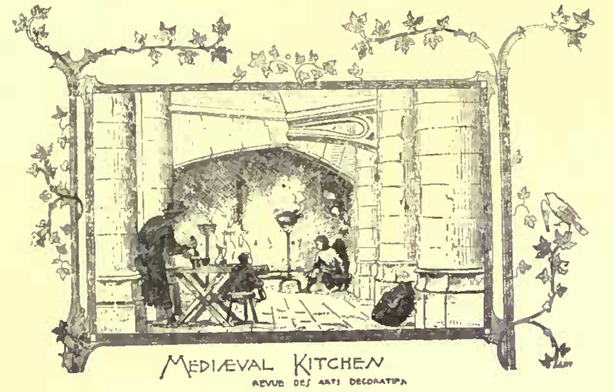
In 1868, a change came over the young man. Up to this date his ideals had been Titian, Ribera, Michael Angelo, Correggio, and (!) Cortona; but now he became acquainted with Fortuny, whose influence Regnault did not live long enough to grow out of. "*J'ai vu des études de Fortuny qui sont prodigieuses de couleur et de hardiesse de peinture. Ah! qu'il est peintre ce garçon-là! Quelle couleur amusante, quel esprit, et quelle justesse dans la touche!*" His first *envoi*, from Rome, "Automédon," scandalized some of the members of the Academy by its exaggerations, its vigor and its departure from *le réglement*. "In what terms is this rebel to be addressed?" they asked. But Regnault had a champion in Pils, who cut them short by asking, "which of you, gentlemen, would be certain to do as much?" An accident, the result of his headstrong daring in mounting a horse which had already thrown several riders, led to an illness which obliged him to leave Rome, and he sailed for Spain. There his enthusiasm knew no bounds. Velasquez is the "Molière of painting, the first painter in the world." He wished to "swallow him," and reproduce him in his entirety. "The Spanish masters are of more use to us than Michael Angelo or Raffaello; they allow you to enter more into intimacy with them. They do not try and hide their methods of execution from you, they ask nothing better than to show you how they work, and do not crush your efforts with their contempt."

And now came the Spanish Revolution, in which Regnault and his friends played a conspicuous part. They seem to have been in the thick of it, singing the "Marseillaise" in cafés, and witnessing the triumphal entry of Prim. So full of enthusiasm was Regnault that he naturally felt rejoiced when he was commissioned to paint the portrait of the Marshal. The horses in the royal stable were placed at his disposition, he had a riding-school to paint in; everything in fact, but sittings from Prim, who was too busy to give up the time. How could the picture fail to be more a portrait of the horse than of the man? "Do not resent it, if you do not find the good man's head finished enough; he did not pose a single second, and I could find no photograph which would help me. . . . I passed two hours in his study, seeing him write with his spectacles on. . . . In spite of all, people find it very like him." Not so Prim, "He was represented at the head of a pack of brigands, a disgusting man who has not washed his face. . . . He was twenty years too old, with a look of fear. . . . And why such a want of *tenue*, and the hair in such disorder?" The painter had the wisdom to guard a discreet silence, although he intimated that he would not alter the picture. "Prim was to forget it like a bad dream," which probably he did, as, after making an *amende honorable*, he refused to pay for it.

The beggars seem to have called up Regnault's enthusiasm as much as everything else that was Spanish. "We have to-day had an honest family, father, mother and child who posed most conscientiously, and expressed their gratitude for forty sous." And how energetically he worked! "At a quarter to 8, a study of a begger to be finished; at 11-30, a visit to Fomento to study a fine Goya; at 1, a sitting for the small portrait of Madame de Barck, in red and black Spanish costume, which *entre parenthéses* becomes her vastly; at 4, a walk to the Salle de Toledo, to see an ancient mantilla, and probably to buy it; at 5, a guitar lesson; dinner at 6; at 7, working again in the atelier. And every day is like this, and it ought always to have been like that." His account of his sojourns with the gypsies is amusing, but too long to be quoted here (Page 54). When Regnault was compelled to return to Rome to finish his second *envoi*, he speaks of being obliged to *dépayser* himself, and his letters are filled with lamentations. "Rome did not suit him; he could not breathe; I feel like the little *gourmand*, who having been eating tarts at the pastry-cook's, only finds a piece of dry bread at home; I am hungry, and I have nothing to eat. There are too many beggars, too many foreigners, too many guides; I would willingly leave all, to find a corner of the earth where I should not be bored by the sight of a green veil or a parasol." But his "Judith" had to be finished, so "no more love, no more riding, no more music; nothing but painting;"—and painting be it remarked, which was not to his taste. Academic studies might have been of value to him, had he lived longer; but dying young as he did, we cannot but lament the time spent upon them. Regnault's talent and his passion were for color, and brilliant effects of light; for all that was picturesque and bizarre. Had he been able to visit India, we should probably have seen the first really artistic representations of it. Vereschagen has done something in this line, but Regnault was a far greater genius, and his teaching of a higher order. As soon as possible he returned to Spain and all his enthusiasm revived. Thence he visited Gibraltar and Tangiers, and so charmed was he with that "*ville de neige*," that he bought a house, and set up an atelier with his friend Georges Clairin. Here the "Salomé" was finished, that much disputed work which set Paris in a blaze in 1870. "That blinding prodigy of Chymistry;" "It is not high art, it is great talent," said M. Ménard. "An incontestable *chef-d'œuvre*," replied Edmond About; while Théophile Gautier exclaimed, "Prim, *c'est toute l'Espagne*; Salomé, *c'est tout l'Orient*." And so on, *ad infinitem*, people feeling so acutely upon the subject, that nothing was talked of, nothing written about but Salomé; for three or four weeks, Paris was divided into two camps; Salomé worshippers and Salomé detractors. But neither friends nor enemies spoiled the painter, and we find him modestly writing that "up to the present time, I have only learned to speak and to eat. . . . All that I have done does not count. . . . I shall commence to decline the moment that I am satisfied with myself." He sketched out a plan of life which would be free of "*petits crevés*," and where "one need not light the lamp at half-past 12 o'clock;" but the war commenced, and far from accepting his exemption as Prix de Rome, he left Tangiers and entered a corps of franc-tireurs. He very soon became disgusted with his companions; and he then joined the Sixty-ninth Batalion of infantry with many other artists, Boulinger, Clairin and Baudry, who, it is said, expressed the desire, that, in the event of his being killed, Regnault should be allowed to finish his Opéra decorations. Fate willed otherwise; and it was Regnault's idea for a grand picture illustrating the domination of the Moors in Spain, which was carried out by a friend—his faithful friend and constant companion, Georges Clairin.

The exhibition which was held at the Beaux-Arts after his death, and appropriately called a "*fête de douleur*," showed the wonderful versatility of the painter; there was no sort of subject that he did not attempt. His instinct was that of the true artist who loves his work for work's sake, not for its subjects; portraits, landscapes, still-life, animals, architecture, all are equally easy to him. Perhaps his *forte* was light; he seemed able to metamorphose paint into Eastern glare; and it is curious that fate should have obliged one who expressed on every occasion his "*haine au gris*," to return north at the very worst time of year, and to suffer the severest cold which had been known for four decades. By his untimely death, art lost much, for, in his own works, he had only just begun to talk. The future would, doubtless, have revealed powers, of which his short life had only given some earnest; and however much we may admire his patriotism, we cannot but regret that a more commonplace brain could not have been sacrificed to the demon, War. S. Beale.

"THE INFLUENCE OF GROUND-WATER ON HEALTH."



MEDIÆVAL KITCHEN
REVUE DES ARTS DECORATIFS

THIS was the subject taken by Mr. Baldwin Latham, M. Inst. C. E., President of the Engineering and Architectural Section of the Sanitary Congress, held last month at York, England, for his address. He said:

In presiding over this section, which is devoted to engineering and architectural subjects, it is necessary that I should say that I have been requested to address you upon a subject which properly belongs to the Climatological Section, namely, upon the probable influence of ground-water upon health. This request has, no doubt, been made in consequence of some observations which have been made in this city by Mr. North, the medical officer of health, who has traced some connection between an outbreak of typhoid fever which occurred here in 1884, and the movements of the subsoil water at that time.

Having devoted much time during the past eleven years specially to the study of the question of underground-water, and having established and maintained a number of stations for observing the relative height of subsoil water in various parts of the country, and having also collected the past records which are available in this country and elsewhere, I am in possession of facts not easily obtainable, and am able, therefore, to draw some definite conclusions as to the probable influence of ground-water upon health. Having regard to what may be called historical records, great periods of drought clearly indicate a low state of the ground-water. In looking through ancient records there are some remarkable references to the influence of drought in producing disease. The influence of light in destroying noxious properties arising from decomposing matter is also clearly indicated, and it is pointed out that the effect of keeping back the waters of the sky, and not suffering them to be poured down on

the earth, would be that the noxious animals which live in the water will pollute it.

No inquiry into the question of the influence of climate on disease would be complete without reference to the labors of Hippocrates. It is curious to note in his works, written upwards of 2,000 years ago, that there are conditions recorded, attending healthy and unhealthy seasons, which are identical with the conditions which may be observed in this country at the present day. Hippocrates taught that all disease may be traced to natural causes, and he counted it impiety to maintain that any one more than another is an infliction of the Divinity. He pointed out to his followers that if they wished to study medicine properly, in the first place they must study the seasons of the year, and the effects which they produce. He also stated that acute diseases occur in periods of drought, and that you could tell what epidemic diseases would attack a city either in summer or winter, and what sickness each individual would be in danger of experiencing. He went much farther than our knowledge at the present time enables us to go; for he stated that the changes of the seasons may be predicted from the rising and setting of the stars, so that we should know beforehand what sort of a year is going to ensue. Hippocrates also pointed out the conditions affecting a healthy period. Rains in autumn, a mild winter, neither very tepid nor unseasonably cold, and rain in spring and summer, the year is likely to prove healthy; but if the winter is dry and the spring showery, the summer will necessarily be of a fertile character. If, at the rising of the dog-star, rains and wintry storms supervene, there is reason to hope that disease will cease, and the autumn will be healthy.

It is curious that a dry winter is often the precursor of disease, not at that time, but in the following autumn. As a rule, a short supply of rain in December has a most marked influence upon the stores of underground water, and a deficiency of rain in this month has probably a greater effect in influencing the future health of any particular district than it has in any other month of the year. As a type of a healthy season the present year is an example, and fully complies with the conditions laid down by Hippocrates.

It may be interesting to note that some years ago Dr. Laycock published an interesting account showing the incidents of disease in York, from which it appeared that this city was always susceptible to violent outbreaks of disease, traceable to local sanitary circumstances combined with peculiar climatological conditions, and that there appeared the same incidence in the prevalence of the sweating sickness of 1550-51, the plague of 1604, and the cholera of 1832, to which might be added the typhoid fever of 1884.

The results of my prolonged investigations on the subject of ground-water in this country and elsewhere, clearly show that there is generally a direct parallelism between the conditions of health and the volume of ground-water. The years in which there has been a large quantity of ground-water present have invariably been the healthiest years, while those in which there has been a small quantity have invariably been the most unhealthy periods.

As a rule, the lowness of the ground-water indicates the future health, and not the state of health at the particular time of lowness; that is, the unhealthy period, as a rule, follows the period of low water, the degree of lowness indicating the intensity of future disease, especially fever. In some cases an unhealthy period runs concurrently with the period of low water, but in all these cases there is clear evidence that percolation has recommenced before the unhealthy period takes place. These results are entirely confirmed by observations which were carried on in Paris between the years 1868 and 1883, and which have been collated and published by M. Durand-Claye, chief engineer of the municipality of Paris, with the object of putting all the facts and circumstances in connection with the outbreaks of fever in Paris at the disposal of those who might choose to investigate the subject — a course strongly contrasting with the conduct of some authorities in this country, who desire rather to hide the true facts from public view.

The observations which have been published by Professor Pettenkofer, and which were commenced in 1854, differ from the experience gained in this country, as he has shown that typhoid fever in Munich commenced with the fall of the subsoil water, and reached its greatest intensity with the greatest degree of lowness, and with the rise of the water there was a diminution of fever, a result exactly contrary to experience in this country. Professor Pettenkofer's observations, however, agree with the observations made here, in the fact that the greatest intensity of typhoid fever coincides with the periods of the greatest degree of low ground-water; that is, those years in which the subsoil water has fallen to its lowest level are those in which there has been the most fever.

With regard, also, to the experience in this country as to subsoil water, it may be pointed out that there is clear evidence that the lowering of the subsoil water by artificial means will produce, and does produce, a tendency to the development and dissemination of typhoid fever. The effect of drainage works during their construction in lowering the subsoil water where precautions have not been taken to speedily and permanently get the water back to its proper level has been, in many instances, the cause of outbreaks of typhoid fever, but which, at the time, have been attributed to the construction of the sewer works and to sewer-gas, even in cases where no connections had, at the time of the outbreak, been made with the sewers.

It may also be pointed out that at the time of the outbreak of cholera in East London, in 1866, as to the cause of which there has been so much dispute, the very district which was most afflicted with cholera had, at the time, its subsoil water unduly lowered by the construction of the main drainage works in that part of the metropolis, and on the completion of this work and the sewers being brought into operation the epidemic terminated. . . .

It is curious that in recent times, as a rule, there has been, every ten years, a marked period of low water; for example, in 1834–5, 1844–5, 1854–5, 1864–5, 1874–5, 1884–5. The lowest water in these series probably occurred in 1864–5. In 1844–5 the low water was not intense, but it was low compared with the period. In addition to these periods there are other times of low water, and in investigating the subject it should be studied locally and comparison made with local vital statistics, for the largely-varying distribution of rain tends to equalize results when spread over large areas, as it is rarely that the same conditions occur over extended areas at the same time.

I have been carrying on, as many of you know, very extensive observations at Croydon, and from the results there obtained have extended them into various geological formations in different parts of the country.

The register of Croydon goes back to the year 1539, and, with the exception of years in which there has been revolution or disturbing causes of a kindred character, the record is complete. A tabulation of the whole of the burials and baptisms, extending from this early period to a date overlapping that when registration of births and deaths commenced, clearly indicates that years of drought are, without exception, the most unhealthy periods. In 1539, the first year of registration at Croydon, there is a record that in this particular year the springs were remarkably low, so low that the river Lea was nearly dried up, and writers of that age remark on the great draught and heat of that period. In that year the number of burials recorded in Croydon was 50, and the number of baptisms 55, indicating a probable death-rate of 25.6 per thousand. In the following year, on the rise of the water, the burials rose to 87 and the baptisms 72, indicating that the death-rate was nearly 32 per thousand. Coming to the period when we have rain-fall records, the year 1741 was a very dry time, the rain-fall at Lyndon for the year being 15.7 inches, and in that year the burials at Croydon were 271, and the baptisms 113, giving a probable death-rate of 63.7 per thousand, while in the two years preceding this year the death-rate was 27.7 and 40.7 per thousand, and in the following year 24.2 per thousand. Coming to more recent periods, when we have the certain records collected by the register-general, registration having commenced in the dry year of 1837, the death-rate at Croydon was 30 in the thousand, and in the following year a similar rate occurred. In the years of very low water, 1854 and 1855, we had death-rates of 26.84 and 21.14 respectively, while in 1851 the death-rate was only 18.72 per thousand. In the dry periods, 1864 and 1865, we had death-rates of 21.5 and 22.7 per thousand, while in 1860, a wet year, and one of high springs, the death-rate was only 17.27 per thousand. The year 1871 was another dry period, but the low water at Croydon was not so pronounced in this year as in most other years. The death-rate was not so high, viz., 18.89 per thousand, but in 1873, when the springs were very high, the death-rate fell to 16.59 per thousand. After the dry period of 1874–75 the death-rate rose again to 21.10 per thousand. From 1876 up to the beginning of 1884, there has been unprecedented high water, and during the whole of this period the country generally has enjoyed a high state of public health. The conditions, however, which have brought about this high degree of health, have been disastrous to the interests of the agriculturalist, as the large quantity of water passing into the ground has washed away the fertilizing elements, but it has secured for us the estimable boon of good health by removing the conditions which are the cause of much sickness, suffering, and death. . . .

It is clear to my mind, after the most careful consideration of this subject, that ground-water itself has no influence, either for good or evil, upon health, but that the lowness or highness of the water in the ground is the index of conditions which greatly influence the health of all communities. We have periods of abundance of water and periods of low water with both healthy and unhealthy conditions. Ground-water has been shown by Professor Pettenkofer to be chemically more impure in periods of high water when the conditions were favorable to health than when there is a low state of the ground-water and a condition unfavorable to health. The records also show that we have periods when rain has started into existence malignant diseases, while, on the other hand, we have similar heavy rainfalls accompanied by a high state of public health, as in the present year.

The records clearly point out that it is not one circumstance alone which produces disease, but that there are at least three factors necessary for the production and distribution of disease, especially typhoid fever, viz.: 1. The elements which produce disease, such as a polluted state of the ground. 2. The conditions which are necessary for the development of disease, such as a period of dryness of the ground in those regions which water usually occupies, combined with a comparatively high degree of temperature. 3. Conditions which will lead to the spread of the disease, such as the probable influence of a storm or rain in driving impurities out of the ground into our water supplies, or through the instrumentality of ground-air passing into our habitations, and its reception by a population which is in a condition to receive such germs of disease. If any one of these conditions is absent, diseases like typhoid do not occur.

The long period of washing and purification which the ground has passed through since 1876, has generally so purified it from the producing elements of typhoid fever, that with the exception of occasional cases of impurity, where the ground has become fouled from the leakage of sewage from the imperfect sewers into the ground, as in the case of this city, Beverly, Kidderminster, and some other places which had epidemics in the low-water period of 1884, the country has enjoyed immunity from diseases of this class. On the other hand, if we take a period when there has been marked low water for a number of years, followed by unusually low water at particular periods, these are the times when typhoid fever is most rife, as, for example, between 1854 and 1865, with the exception of the years 1860 and 1861, when we had a high state of ground-water. The intensity of the fever rates of 1865 and 1866 point out a lesson which ought to be learned by every sanitarian, — that we must keep the ground free from impurity, if we are to secure conditions which are essential for the promotion of health.

When we come to deal with local conditions preceding disease, we find that not only cholera and typhoid fever, as pointed out by Professor Pettenkofer, are amenable to the conditions indicated by the highness or lowness of the ground-water, but probably all other zymotic diseases are influenced by the conditions which produce low ground-water, with the exception of diarrhœa. . . .

We must not, however, lose sight of other conditions which are at work, such as, —

(1) *The influence of light.* It will be observed with reference to the period of percolation that is almost parallel with the time the sun is below the horizon. The influence of solar light is well known in malarious countries, which may be traversed with impunity while the sun is above the horizon, but they become dangerous after nightfall. (2) *The influence of temperature.* There is no doubt that, in winter time, many diseases are aggravated by the intensity of cold, but cold is not essential to the promotion of disease, especially in children under five years of age. This was shown by the late Dr. Farr, and in the volume recently published by the Sanitary Institute it is pointed out that the death-rate of children in Norway is lower than that of England, while the death-rate of children in England is lower than in Italy, indicating that at this period of existence cold is not detrimental to life. When we come to isolate the deaths in particular months, and compare them with the periods of low water, it often happens that extreme low water in winter corresponds with periods of great cold, and low water in summer also corresponds with periods of great heat, and it is only at such times when we are able to discount these influences by comparing them with periods when we have a normal state of things with reference to temperature, and abnormal in regard to ground-water, that the influences measured by the ground-water are brought into prominent relief. . . .

A very marked circumstance in connection with ground-water and the period of percolation is shown in the case of deaths of children under five years of age. While there may have been mistakes with reference to the causes from which a child dies, very little error occurs with regard to its age. I am of opinion that the proper way of estimating the sanitary state of any period in any district, is by taking the number of children under five years of age and calculating the deaths by the number living at these ages. The figures show, especially after deducting the deaths from diarrhœa, which are influenced by high temperature, that there is an almost exact parallelism between the period of percolation and that of deaths occurring at those ages, the smallest number of children dying in the month of June, and the largest number in December and January. Moreover, the death-rate from year to year fluctuates in a very marked manner with the fluctuations of the ground-water. The most healthy periods in which there is the most ground-water, and the least healthy are those in which there is the least ground-water in any year. These results corroborate the strong relation which exists between the highness or lowness of water in the ground in regard to zymotic diseases. It also shows that there are influences at work which can be measured by the quantity of water in the ground, which are destructive to young life, and which may be guarded against, as these influences indicate themselves many months before they begin to affect the population; therefore "to be forewarned is to be forearmed."

The fluctuation of the water line is an essential condition in the development of disease, especially typhoid fever and cholera. It has been pointed out by Professor Pettenkofer that in those districts in which the rivers are held up at uniform levels by weirs, the conditions are favorable to health, and in such districts cholera rarely becomes epidemic. In a great measure this is corroborated in this country by the state of health at our seaside resorts, which being the natural outflow for ground-water, and owing to the uniform height of mean tide level, are without exception placed in a condition favorable to health. We have also the record in connection with the city of York, in which it is clearly shown by Dr. Laycock, in his report on York, published in the first volume of the Health of Towns Commission, that previously to the construction of the lock at Naborn, below the city, the tide used to flow up above York, and there were considerable variations in the level of the waters from time to time, but after the construction of the lock in question the health of York materially improved. The health of districts such as the Wandle Valley is proverbial. In the latter district there are a large number of mills in a comparatively short length, holding up the water to a uniform level.

With such examples for our guidance it is clear that sewers may be of great advantage in maintaining uniformity in the water level. On the other hand, leaky sewers are liable not only to pollute the ground, but to cause considerably greater variation in the levels of underground water than would otherwise occur in various parts of the district. Good land drainage has a tendency to produce uniformity of water level, but this should rarely be attempted to be secured through the instrumentality of sewers carrying polluted matters. The influences which are observed clearly point out how important it is to guard districts against pollution of the earth. How little regard, however, has been paid to this point, for it is only within the last ten years that the importance of making sewers as water-tight as possible has received serious consideration, and still, in many parts of the country, sewers are being constructed without any regard to water-tightness and their other influences on ground-water. Moreover, a large number of burial-grounds have been established, in quite recent periods, in positions with respect to underground water which more or less exercise a baneful influence on the health of the localities in which they are situated. Cesspools, ash-pits and middensteads are still permitted to poison the air, ground and water. No wonder that the towns which possess the means of most readily polluting the ground have, without exception, the highest rates of mortality. There can be no compromise in sanitary matters. What should be the aim of all sanitarians is the preservation of the ground from all impurities, especially in districts where the soil is of a porous character, and, above all, no supplies of water for dietetic purposes should be permitted to be taken from wells sunk in the immediate subsoil in populous places, and to secure the full measure of health, our houses should be so constructed as to prevent the admission of ground-air into them.

SOCIETIES

GERMAN TECHNICAL SOCIETY.

At the annual meeting of the "Technischer Verein" (German Technical Society), of New York, held October 9, the following officers were elected: *President*, T. H. Miller, Mech. Engineer; *Vice-President*, G. W. Wundram, Mech. Engineer; *Cor. Secretary*, H. W. Fabian, Architect; *Prot. Secretary*, G. Landsmann, Chemist; *Treasurer*, A. Drögmundt, Mech. Engineer; *Librarian*, H. Bausch, Civ. Engineer; *Trustees*, A. Kurth, Civ. Engineer, P. Gopel, Civ. Engineer, A. Siebert, Mech. Engineer. The number of members at present is: Section of Civ. Engineers, 49; Section of Mech. Engineers, 87; Section of Architects, 35; Section of Chemists, 32; total, 203. Employers who are in need of assistants may address the Corresponding Secretary, H. W. Fabian, 705 Broadway, New York City.

H. W. Fabian, *Cor. Secretary.*

COMMUNICATIONS

INTERMITTENT *VS.* PERSISTENT DISCHARGE FOR SUBSURFACE DRAINAGE.

New York, October 9, 1886.

To the Editors of the American Architect: —

Dear Sirs, — Will you kindly permit me a few words of explanation in regard to the question raised by a correspondent in your issue of September 18, and referred to in a letter of Mr. C. W. Durham, C. E., in the issue of October 9, of your valuable paper. Speaking generally, I consider an *intermittent* discharge far preferable to a continuous overflow from a sewage-tank into a system of absorption tiles. In the special case referred to by Mr. Durham, and which you criticise, I omitted the usual siphon, principally because the owner of the country-house desired to have the work constructed as economically as possible. I should state that in his case the problem was a comparatively simple one, as it involved only the disposing of the waste water from a single bath-room, containing one wash-bowl, one bath-tub and one water-closet. No grease at all from kitchen or pantry sinks entered the sewage-tank. I explained to the owner that in doing away with the intermittent siphonic discharge I was not following my usual custom; that, indeed, I was trying a novel experiment, of the success of which I was not quite sure at the outset. Receiving the owner's consent to try the experiment, I built a small circular settling-chamber of brickwork laid in hydraulic cement mortar. The soil-pipe from the bath-room discharges into this settling-chamber in the usual manner; but the outlet from the tank was not, as stated by your correspondent," a simple overflow," but consisted of a series of six or seven small overflow pipes, each having a deep dip into the chamber, so as to prevent any solid matter from being carried over into the absorption tiles. These overflow pipes were placed with great care at as nearly as possible, the same level, and were thus made to take each a share of the overflowing sewage. The object of this arrangement was to insure an equal or nearly equal distribution of sewage into each of the six or seven rows of tiles. The bath-tub and water-closet being used only at intervals, the discharge from the sewage-chamber was comparatively intermittent,

and, to a certain extent, approached an intermittent siphonic discharge, inasmuch as at each use of the bath-tub a rather large volume was sent suddenly into the tiles. So far as I know this system has worked to the entire satisfaction of the owner, during a period of two years, without clogging up or necessitating the removal and relaying of the tiles.

I fully agree with you that in the case of larger sewage-tanks, the intermittent discharge is essential, as well as better and cheaper in the end. I am now preparing the plans and specifications for a 30,000 gallon sewage-tank, to be built at the Hospital for the Insane, at Middletown, N. Y., and have recommended in my preliminary report an intermittent discharge. I explained to the Building-Committee that it was comparatively immaterial how this intermittent discharge was effected, and left to them the choice between a simple gate-valve arranged to be operated by hand once a day, and an automatic siphonic arrangement. The latter was considered by them far superior, as doing away with the necessity of constant attention to the tank. In the case of country-houses having a large amount of plumbing fixtures, I also consider an intermittent automatic discharge as vastly preferable, and I do not consider the addition of a siphon, of whatever make, as complicating the work to any extent.

Respectfully yours, WM. PAUL GERHARD, C. E.

UNSOLDERED CROSS-SEAMS.

ORLANDO, FLA.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you please answer by letter the following, and oblige? Is it good practice to lay a standing-seam tin roof with unsoldered, single-locked cross-seams on roofs of little pitch? I have a roof in charge which of necessity has only ¾″ to 1′ pitch, and the tinners, in the absence of specifications to that effect, refuse to solder the cross-seams, and contend that it will not improve the roof and is not good practice. Am sorry to trouble you with the question, but have no other means of finding out.

Yours truly, ARTHUR C. ALDRICH.

[WE should think the pitch too low for cross-seams without solder. — EDS. AMERICAN ARCHITECT.]

PLUMBING JOINTS.

HARTFORD, CONN.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In what early issue of your paper did you accurately describe the various joints used in plumbing work? What is the particular name of the curved coping sometimes put over Renaissance cornices in interior work? Shingles on upper stories of houses are often carried out the same way for practical reasons. Would the same name be applicable, or would the present "apron" be better?

Respectfully, H.

[1. SEE Mr. Putnam's "*Sanitary Plumbing,*" in Vol. XIV. 2. We know of no name for the curved weathering for cornices. — EDS. AMERICAN ARCHITECT.]

NOTRE DAME DE LÉPINE.

BROOKLINE.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In the issue of August 28, the article "An Editor's Trip Abroad," has an illustration of a "doorway of Notre Dame de Lépine, France."

Would you kindly inform me where I could find further information of the town Lépine, as I understand it to be a town, and of this church. Very truly yours, MRS. D. H. R.

[LEPINE, or L'Epine, is a little town in the Department of Marne, not far from Châlons. All we can discover about the church of Notre Dame is that it dates from the fourteenth to sixteenth centuries, and is styled a "miniature cathedral." — EDS. AMERICAN ARCHITECT.]

ELEVATED RIDING-RINGS.

NEW YORK.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I have in hand a scheme for a boarding and livery stable, in connection with which will be a riding-ring built on the fourth floor, and whose area is to be entirely unobstructed; the plot is about 70′ x 100′.

I write to ask whether you can tell me anything of the construction of the St. James Riding-School, on Washington Street, above Dover Street, Boston, which, I am informed had an elevated riding-ring, and which collapsed several years since.

With the proper calculations made for both dead and live loads and the resultant vibrations, I fail to see why an elevated riding-ring should not be constructed and be compatible with perfect safety and be made to pay on a circumscribed city lot.

If yourselves or any of your readers should happen to be familiar with the facts of the case above cited, or could note any other instance of an elevated riding-ring, a brief description of the construction and dimensions would be gratefully appreciated by

Yours respectfully, GEORGE MARTIN HUSS.

[WE have been able to learn only that it was not the St. James Riding-School that fell down, but one known as Draper & Hall's. But better than either and larger is one on Washington Street, above Dover, of which the ring is about ninety-six feet across and octagonal in shape. This ring is in the second story, and is supported on iron columns which do not interfere with the use of the carriage-room below. Each of these three rings is in an upper story of its respective building. — EDS. AMERICAN ARCHITECT.]

CASTING FLUTED PLASTER COLUMNS.

CLEVELAND, O.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I want to run some fluted columns with plaster, say, 6′ in diameter at the base, 4′ 6″ at the top, and 40′ high; how can I do it so that the flutes and squares will diminish gradually from the bottom to top? Please answer, if you can.

I am yours, etc., JAMES SMITH.

[IT is impossible to run diminishing fluted columns. They must be worked by hand, or cast in sections. — EDS. AMERICAN ARCHITECT.]

A POROUS WOOD-PRESERVATIVE.

BOSTON, October 9, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — It is gratifying to observe that what is now known as "the mill floor," to wit, heavy beams set wide apart covered with solid plank, is being introduced in many city buildings. I have observed in one or two cases a cause of danger where this method has been adopted which is easily avoided and which should be very carefully avoided. I examined a building yesterday in which all the beams have been varnished. This may be fatal to the stability of the building. If the pores are stopped by an ordinary paint or varnish, what is known as dry-rot may and probably will occur, to the total destruction of the beam within three years. I have had such a case in a factory under my own administration, and I know by bitter experience what the danger is where the seasoning of these timbers is prevented by putting a water-proof covering of any kind on the outside. If it is thought necessary to treat these beams in any way until after three years, I may recommend a new wash lately invented by Professor John M. Ordway, which can be obtained from Mr. G. F. Ordway, 766 Dudley Street, Boston. It is, to a certain extent, a preservative of timber and a fire-resistant. It is porous, and, therefore, will not cause timbers to rot. It appears to have a good surface for the reflection of light, and could hardly be distinguished from a good paint; in some respects it is preferable to a paint. What its durability may be I cannot state from experience. It is intended for inside use only, but anything invented by Professor Ordway would be very sure to possess great merit.

Very truly yours, EDWARD ATKINSON.

RELATIVE STRENGTH OF WET AND DRY TIMBER.

BOSTON, October 11, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — On page 168 of your issue of last week is a clipping from the *American Miller*, which strives to show that green lumber is stronger than dry, despite the contrary statements of all authorities on the subject. A little calculation, however, will show that it is only another case of over-loading, so common in the West. The beams, we are told, were of pine (presumably Michigan pine), 3″ x 12″, 12″ on centre and 12′ long. To make the case as strong as possible we will assume the span as 11′. The greatest safe load, then, per lineal foot of span, should not exceed $\frac{2\times3\times(12)^2\times100}{(11)^2}=714$ lbs. Assuming the weight of wheat at 85 lbs per cubic foot, the load per lineal foot on the beams when green was $26\times85=2210$ lbs., or over three times the safe strength, and in the neighborhood of the breaking strength. This load undoubtedly crippled the beams, so that when the next load was put on them they broke. A few years ago the writer made a long series of tests on white-pine beams, by which it was shown that one-half the breaking-load on a beam will ultimately produce fracture. Very likely the sap in the pine added somewhat to its stiffness, but the beams were so short in proportion to their depth that they would break without showing any great deflection. The most crude calculations should have shown the designer of the building in question that the beams would break in time, even under a much less load than 24 feet of wheat.

Yours truly, F. E. KIDDER.

NOTES AND CLIPPINGS.

A VISIT TO THE GRANDE CHARTREUSE. — From the chapel a gallery named the Allée des Cartes — because it contained, until the Revolution laid its rude hand upon them, pictures representing most of the old Carthusian houses — leads to the Chapter-House, where the Chapter-General holds its annual meeting, and which contains, in addition to a fine statue of St. Bruno, portraits of the first fifty generals of the order. Some of these portraits are very poor works of art, but they are supposed to be faithful likenesses, most of them having been done from life. Into the functions of the Chapter I need not enter, and will go on to speak of the cells in which the monks pass nearly the whole of their lives. These are approached as one comes out of the Chapter-House, and open on to

what is called the Grand Cloister, a gallery 705 feet long and lighted by 113 windows. This is longer than the Roman basilica of St. Peter's, and it combines three distinct orders of architecture, for the Grand Cloister was not built all of a piece, the first part having been erected as far back as 1132, after an avalanche had destroyed the existing monastery. Opening on to the cloister are the cells in which the monks spend their lives, and over each is some such inscription as: "*O beata solitudo, o sola beatitudo!*" The cells are all exactly alike, and a description of one will do for all. That which I inspected was occupied by a young Englishman, the son of a Suffolk clergyman, who had gone over to the Church of Rome, and who himself had felt the vocation for a contemplative life. He had only been one or two years at the Grande Chartreuse, but there was upon his face that contentment which, as St. Augustine says, comes up from the heart to the countenance and tells of a mind at peace with itself. There are two stories to the cell, upon the ground floor being a room for cutting and storing wood, and another with a lathe and carpenter's bench. Upon a level with these, but in the open air, of course, is a small garden; for the Carthusian rule is that the monks should seek relaxation and exercise by gardening, carpentering, and so forth, rather than by walking. This is very wise, I think, for the mind is always more or less upon the stretch when one is walking, whereas in gardening and carpentering one can exercise the body and at the same time must direct one's thoughts into an entirely new channel. Upon the floor above, which is reached by a narrow flight of steps, is the room in which the monk lives. It is divided into two by a wooden partition, but the first room is merely furnished with a table and a chair, and it is here that he takes his single meal. For though the monks are allowed a little bread and wine in the evening — except at the great feasts — they have only one meal a day, and that, with neither meat nor any of the luxurious dishes which good Catholics partake of with a good conscience upon fast days, is but a modest one. The inner room contains a bed, which is enclosed in an alcove, and is not unlike those with wooden skirting to the sides often met with in old Dutch houses, and it is *outside* this bed, which is innocent of sheets or pillow-cases, that the monk takes his rest. In former times there were shutters to the bed, so that in cold weather the occupant could pull them to, but this being deemed unhealthy, they were removed, and a couple of blankets are now provided. The room has no other furniture save a washstand, but in an inner recess there is a writing-table with some book-shelves over it, and this is literally all, excepting, of course, a crucifix over the bed and another over the writing-table. The food is passed in through an aperture in the door before the ground floor, as the monks of La Grande Chartreuse only take their meals in the common refectory upon Sundays and certain high festivals, and when they do so no conversation takes place, a lay-brother reading from a lectern in the gallery which overlooks the refectory verses from the Bible or a chapter from one of the fathers of the Church. Upon Sunday evenings each monk comes to the door of the refectory and asks as a beggar in the name of Christ for alms, the lay-brother giving him a piece of bread and saying: "*Requiescat in pace.*" This refectory, built in 1371, was restored in 1494 by the liberality of Margaret of York, widow of Charles the Bold; and among other English princes who have been benefactors of La Grande Chartreuse, I may mention Cardinal Henry of Lancaster, who rebuilt part of the monastery in 1444; Edward III, who had contributed towards the restoration of the church in 1371; Henry II, who assigned to the Grande Chartreuse in 1185 a perpetual (?) income upon the English exchequer, and Richard Cœur de Lion, who confirmed this gift a few years afterwards.—*Temple Bar.*

Decadence at Versailles.— The citizens of Versailles have petitioned the French Chambers to save the palace and park of Versailles from falling into ruin. One of the buildings which bears the inscription "A toutes les Gloires de France," has already lost all its sculptural ornaments, and the condition of the upper cornices is such as to be dangerous to passers-by. The terraces of the *orangerie* are in a similar state. Hundreds of trees, particularly the beeches, many of which date from the time of Francis I, are dying. Little Trianon is in a comparatively good state, but Grand Trianon has become a perfect wilderness. For two years no gardener has entered that magnificent park, whose paths and basins are overgrown with grass. One of these basins is a total wreck, English (!) visitors having broken the arms off the statuettes surrounding it. Formerly, the cost of keeping the palace and the garden of Versailles in repair was defrayed out of the civil list.—*N. Y. Evening Post.*

A new Way to collect a Lien.— All the world loves a lover, according to Mr. Emerson. Charles Ohman, a Chicago contractor, who built a house for Andrew Anderson, in which the latter was married, took occasion, just as the wedding was well under way, to take possession and endeavor to nail up the doors and windows, because he had a lien on the building for an unsettled balance. All hands turned on the intruder and put him out, and there was such a row that the police wagon was called and the entire party arrested except the minister, who escaped. After explanations all were released but Ohman, who was held and fined. The others went back, found the minister, and Anderson was married.— *N. Y. Commercial Advertiser.*

TRADE SURVEYS

The writers of financial and commercial reviews in the leading daily and trade papers of the country, in endeavoring to arrive at results, permit themselves to be misled by the unfavorable statistics of through traffic. They ignore unintentionally the enormous increase in traffic and business in the interior which shows itself only in local traffic. The tonnage shipped westward from New York by the trunk lines and canals for nine months this year show an increase of only two and one-half per cent over the shipments for the same time last year. The trade statistics of our large manufacturing and commercial centres show less and less of the trade movement each year. There is an enormous volume of unreported business throughout the country at large. There is no easy way of getting at this total, and yet, a proper understanding cannot be had without such material. Yet even the scattering railway returns available show that we are making healthy progress. The returns from seventy-eight roads for September, and for nine months this year over nine months last year, exhibit a healthy increase. Railway mileage is also increasing rapidly, and the construction this year will, no doubt, be fully double that of last year. The returns from a score or more of industries, so far as they can be relied upon, indicate not only a great increase in the volume of business this year over last, but indicate a further and increasing volume of business to be taken care of during the coming months. Builders, investors, manufacturers and merchants have been watching trade and trade-features with a keen eye to see whether the improving conditions of the past year or more are likely to continue. It is easy to draw erroneous conclusions. It is pleasant to deceive ourselves sometimes. It is as possible to make mistakes now as one, two, or three years ago. The possibility of drawing wrong conclusions is greater now than heretofore; it is, therefore, very necessary to probe every fact with skill, and to detect whatever elements of weakness there may be. It is known among capitalists that there is a desire and intention to make very heavy investments next season, not in one or two channels, but in many. Heretofore railway has been our favorite pastime; there will be less of this hereafter. There are some forty or fifty railroad-building schemes before the country which, in all probability will go through. They are in the hands of strong American and British capitalists. It is not the intention of their managers to peddle their stocks in the open market. Comparatively little is said of these enterprises beyond the mere announcement that such enterprises are projected. Rail-makers, locomotive-builders, and railway-supply men, have knowledge of most of these projected works. If nothing intervenes they will be set on their feet next spring. The discussion in reference to them is not whether they will eventually pay, but whether the year 1887 is a good year to project enterprises calling for the expenditure of hundreds of millions of capital. The investors would willingly and gladly wait a year or two longer before inaugurating their schemes if they thought that the pushing of them next year would result in or produce a crowding up of prices. This is the question at issue. It is a difficult one to determine. The conditions are right for an improving industrial activity. There is an abundance of money ready for the work. A ten or fifteen per cent advance would cause the projectors of a score or two of great enterprises no inconvenience provided it should not be followed by a reaction a year or two later. In short, the manufacturers, capitalists, and builders of to-day want to feel assured against the ups and downs of prices and the violent fluctuations of trade which do so much harm.

The facts presented in their briefest shape are these: the enormous producing-capacity of the country is the best guaranty against either an over-production on one hand, or a wild anticipation of requirements on the other. The effort is now being made in all of our industries, to broaden their foundations far enough so that there will be no occasion for buying this week or month what will not be wanted for three or six months. The railroad-builders are obliged to do this just now. They have been once more taken by surprise. Had they known last year what they know now, they would have built 6,000 miles of railroad instead of 3,000, and the managers of our 130,000 miles of railway would not have permitted their rolling-stock and locomotive-power to run down to a point which has made it necessary this year to let freight blockade itself all over the country, and to disappoint shippers and consignees with unnecessary delays. The railroad-builders have bought a quarter of a million tons of rail this autumn, to be furnished them next spring. There are inquiries on the market to-day for no less than 100,000 tons of rail. The railroad-builders do not now know whether to build, or arrange to build, six or eight thousand miles of road next year, or ten or twelve thousand miles. If prices remain where they are, or are likely to remain, the highest figure will be reached. The same policy will guide the leaders in every other industry. It is not higher but lower prices that are feared. Not the effects of a healthy activity, but of an unhealthy reaction. The locomotive-builders have instructions and orders to hasten forward their work, and are advised by inquiries for next year's work not to let their capacity decline. Last week orders were given by two trunk lines for 5,000 freight cars. The railroad companies generally will crowd the railroad-supply capacity of the country all winter. There is an urgency which points to a busy year from January 1. There is no doubt but that an improving traffic will increase expenditures which have already been delayed too long. The same healthy activity is observable in the mining industry, in the lumber industry, in petroleum, in implement-making, in machinery-building, and in all directions. The leaders of our industries know the danger that besets them; they are, therefore, doing their best to guard against it, believing that the producing capacity of the country will be expanded with sufficient rapidity to prevent any unnecessary advance in prices, or impart any undue activity.

All these considerations underlie a proper understanding of the building interests. A large amount of money has been offered to push building enterprise, to lay out new towns, to establish new industries, lake and river and ship lines, and to inaugurate important engineering enterprises. Our advices from interior New England points seem to be satisfactory to architects and builders as regards next year's probabilities. Very favorable advices have been received from New York, Philadelphia, Chicago and St. Louis. There is a healthy activity in real-estate operations. City and suburban real estate is changing hands to be built upon. A great many large structures for business purposes are to be built next year in New York, on which architects are at work. The upper section of the city between Sixtieth and One Hundred and Twenty-fifth Streets, and between the park and the river, will be the centre of the great building activity. Two important enterprises are attracting attention in Philadelphia. One is the projected construction of an elevated railroad passing through the city parallel with the Delaware River, and extending to the extreme northern limits of the city. Another is the projected construction of an underground system with numerous convenient stations. The capital for both these enterprises seems to be ready. In Chicago the leading builders there speak of the very strong probabilities of a very active building season during the winter and spring, particularly in the direction of business edifices. There is also a very great demand for more small houses in that city and in several of the manufacturing towns of that State. These favorable prospects are leading to activity among material and supply men and among the makers of small machinery-tools and engines. It is not, therefore, to be wondered at that prices are firm, that confidence is strong, that real estate is pointing upwards, that railroad-builders are confident, and that universal preparations are being made to harvest all the results which enterprise can plant.



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THE people of Paris have entered with enthusiasm into the project for the exhibition of 1889, which they now propose to call the Exposition du Centenaire, after the fashion of our own Centennial Exhibition, in commemoration of the hundredth anniversary of the first acts of the French Revolution, that wonderful struggle of the noblest aspirations with the accumulated brutality of centuries. As soon as the matter took definite shape a Guarantee Association was formed, to take charge of securing subscriptions to a fund for making good any deficiencies, if the receipts, as often occurs in such affairs, should prove insufficient to pay the expenses. The Association, after calculating the probable costs, as well as the income, of the exhibition, decided to call for a fund of eighteen million francs, or three million six hundred thousand dollars, and in three months this sum has been substantially assured, and more might easily be obtained, if the Association should wish to ask for it. The partial list of subscribers which has already appeared in *Le Génie Civil* is interesting reading, as showing how generally the people who can afford to do so are disposed to aid the project. With us, the railway companies and the hotel proprietors have usually been the most liberal subscribers to great exhibitions, but we find, curiously enough, that in Paris the largest subscriptions are made by the banks, which would appear to have very little selfish interest in the matter. Two of the most generous subscriptions among these, moreover, are made by corporations which lend money only on mortgage of real estate, and having no circulating notes, and no prospect, so far as we can see, of increasing either their business or their security by attracting strangers for a few months to the city, must sincerely regard their enormous subscriptions, of one hundred and twenty thousand dollars each, as sacrifices in the cause of patriotism and civic pride. The names of these two corporations, the Sociéte des Immeubles de France, and the Crédit Foncier de France, deserve to be long remembered, and with them should be joined that of the Banque d'Escompte de Paris, which offers an equal sum, but may, perhaps, hope to get back a portion of it in profits on the increased volume of money which would be likely to pass through its hands. The Bank of France, the rival of the Bank of England in conservative solvency, subscribes one hundred thousand dollars, and five or six local banks offer sixty thousand dollars apiece. The two great retail dry-goods stores, the Grands Magasins du Louvre and the Bon Marché, subscribe one hundred thousand dollars each, and the complete list will probably show similar subscriptions from one or two other establishments of the same kind. The proprietors of the Grand Hotel, which will probably profit greatly by the Exhibition, subscribe only twelve thousand dollars, which seems a small sum in comparison with those set down opposite the names of the banks; but, except the Hotel Bristol and the Hotel Chatham, which give two thousand dollars apiece, and M. Heriot of the Hotel du Louvre, we find no other inn-keepers represented in the first list, unless we include among them the managers of the Etablissements Duval, who subscribe one thousand dollars. A great deal of money is promised by private individuals, among whom the most conspicuous are M. Lockroy, the Minister of Commerce; M. Christophle, the famous Governor of the Crédit Foncier; M. Chabrières-Arlès, tresorier-payeur, or, as we should perhaps say, comptroller of the province of the Rhone; Madame Desgenetais of Paris, and the Count de Germiny, comptroller of the Lower Seine, who give ten thousand dollars apiece, and M. Lavoignat of Paris, who gives twenty thousand. The newspaper proprietors, who are in France usually liberal, and often rich, are, so far, represented only by M. Labon, the director of *La France*, and M. Muller, President of the Council of *Le Génie Civil*, who in their private capacity, we presume, give two thousand dollars each. A few associations of manufacturers, in their collective capacity, subscribe large sums, one very modest one, that of the sausage-makers, offering four thousand dollars; but most of them appear as subscribers only through their members, many of whom have shown exemplary liberality. Among the individual manufacturers or firms, the most conspicuous are perhaps the Mediterranean Iron Company, and M. Marinoni, a machinist of Paris, who give twenty thousand dollars each, and M. Menier, a merchant of Paris, who gives thirty thousand, while the Chaix Printing Company, Christofle, the jeweller and manufacturer of bronzes, the Paris Water Company, the Compagnie des Voitures, Darblay & Son, paper-makers at Essonnes, M. Groult, a miller, and several others give ten thousand each. A few architects, among them M. Laisné, M. Boulanger, M. Fonquiau, M. Courtois-Suffit, and others, appear also as subscribers.

ONE can hardly help thinking of the old proverb, "that when rogues fall out, honest men get their due," on learning that the long dispute between the master plumbers and their journeymen in New York is to be enlivened by a system of espionage, which the journeymen are said to have established, with the view of annoying their former masters by finding out defects in their work, and making complaint to the health authorities. One or two complaints have already been made, which resulted in the condemnation of the work reported upon by the health officers, and it is much to be hoped that the animosity between the factions may continue to gratify itself in this way. If report speaks true of what has happened in other cases of the kind, some of the journeymen can speak with confidence of defects in the work for which their own former employers are responsible, through their recollection of having done the bad work themselves, and we have heard tales of workmen who have unblushingly avowed their own misdeeds when they found that they could get their former masters into trouble on account of them. It is only fair to say, however, that plumbers as a class are much above the meaner tricks of this sort, and we do not doubt that the journeymen's committee of censors really desires to do a service to the public at the same time that it annoys the masters, and so far we wish it success. Whatever assists and enforces good work is an unmixed benefit to the community, and if the journeymen would persevere until all the bad plumbing in New York has been ferreted out, and all those responsible for it held up to scorn, they would earn respect and commendation from the public.

THE first annual report of the superintendent of the new Niagara Falls Reservation gives a most encouraging indication of the benefits which will come from the purchase of the territory around the cataract, and its dedication to the public service. Within the year no less than thirty-one buildings have been removed from the immediate vicinity of the Fall, among them being the six unsightly structures of the Bath Island paper mill. The buildings in Prospect Park, with some small shelters for visitors on Goat Island, which it was thought desirable to retain, have been repaired and put in order, and the walks and pleasure grounds have been cleared and made neat. One result of the conversion of the place to public uses has been a great increase in the number of visitors, and it is believed by those who ought to know best that the forlorn and deserted days of Niagara are over, and that the village will soon recover the gayety and prosperity which distinguished it fifty years ago. To accommodate the growing

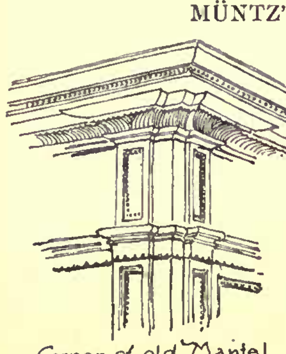
multitude of strangers, the approaches to the Falls have been improved, the guard rails in the dangerous portions extended and strengthened, and steps taken toward providing a more convenient access to the Cave of the Winds. A careful examination has shown that the central portion of the Horseshoe Fall has receded two hundred feet toward Lake Erie within the past eleven years, while the average rate of recession of the whole cataract has been about two-and-a-half feet per year. For this reason it is probable that all the constructions at the edge of the Falls will be of a temporary character, but care is to be taken to have them safe and convenient. For the further accommodation of visitors, moreover, contracts have been made for cheap transportation by carriages about the Reservation. It is many years since the exorbitant rates of carriage hire, the tradition of which still persists in the facetious columns of the newspapers, gave place to a very moderate tariff, but even this has been reduced, and a carriage service established which closely resembles the excellent system in use in the New York Central Park. It is gratifying to learn that the Government of the Province of Ontario is likely very soon to take possession of the Canada side of the Falls, and devote it to the public use in a similar way. The preliminary surveys made for the purpose by the Niagara Falls Park Commission of Ontario are completed, and estimates made, which show that the cost of acquiring the ground will be about four hundred and twenty-four thousand dollars, and the Legislature is to be asked at the next session to make the necessary appropriation.

WE are not quite sure whether it is more for the public benefit to encourage amateur dynamiters with political convictions to make personal experiments in the composition of new explosives, or to try to conceal from them the results of scientific inquiry into the subject, but, as there is always a doubt as to the success of efforts at concealment or deception, perhaps it is better to make a virtue of necessity, and point out the excellent opportunities which are now offered to those interested in the suppression of tyranny for making themselves acquainted, at small expense, with the properties of high explosives. It is not long since a process was described for developing the detonating quality of brown sugar, and at nearly the same time appeared a device for converting coal-tar into a substance far more dangerous than gunpowder, and a third invention has now been described, by which a material so innocuous in appearance as common glue can be transformed into an explosive possessing a force comparable with that of nitro-glycerine. The recipe for the preparation of this socialist glue is very simple. The glue of commerce is first soaked in cold water, until it has taken up all that it will, and the resulting jelly-like mass is then melted at a gentle heat, filtered, and mixed with nitric acid enough to prevent it from solidifying again when cold. The glue is then subjected to the action of a mixture of nitric and sulphuric acid, and, after thoroughly washing away the excess of acid with water, is fit for use. We can add nothing to this description, except a suggestion that it might be an excellent idea for those who desire a forcible inversion of the social fabric, by which they should themselves be brought to the top, to provide themselves, for the enlivenment of the meetings of their organizations, with bowls, in which they might amuse themselves by brewing, in a sociable manner, the substance which they regard as the means of accomplishing their end. One of the members, for instance, might be appointed to soak the glue, another to add the nitric acid, and a third to mix the vitriol, while a fourth might with advantage be deputed to apply, by means of the red-hot poker, which would so well typify the ardent sentiments of the fraternity, the gentle heat which, as we are told, is essential to the completion of the intended reactions.

ACCORDING to the *Revue Industrielle*, the European jewellers and dealers in precious stones have within a short time been disturbed by the appearance in the market of artificial rubies, so closely imitating the natural stone as to be practically indistinguishable from it. In fact, as careful analysis shows, the natural and the artificial stones are identical in color, in composition, in cleavage, and in refracting power, as well as in density and fusibility, the only difference detected by the most careful tests consisting in the presence, in the artificial rubies, of minute bubbles of gas, sometimes elongated in parallel lines, and showing that the stones in which they are found have once existed in the form of a paste, probably by the melting together of their ingredients. Although such bubbles are never found in natural rubies, they are likely, through the reflecting surfaces which they present, rather to increase the brilliancy of the stones, and it must be regarded as certain that some one in or near Geneva, whence all the specimens are said to come, has discovered the means of making by artificial processes, out of cheap materials, jewels which sell readily at a very high price; a large ruby, as is well known, being worth more than a diamond of the same size. The French association of diamond merchants has, it is true, condemned the Geneva stones, pronouncing them not to be rubies; but if the inventor should be careful enough for the future in his processes to avoid the production of bubbles, which does not seem very difficult, there would be no means of distinguishing his product from the natural stones, and the decision of the association would have no effect whatever. As a manufacturer of artificial jewels would find it for his interest to scatter his goods as widely as possible, to prevent any particular market from becoming overstocked, to the detriment of the price, it is quite likely that some of the Geneva stones may have already reached this country, and the purchasers of precious objects of the kind would, perhaps, do well to investigate the subject.

EVERY one who remembers the Louvre and the Tuileries, as they appeared before 1871, and who has seen them since that time, must have been shocked at the change which has been wrought in that most august group of buildings. Our own earliest recollection of the place extends only to a remembrance of what it was about ten years ago, but even then the stately and silent courts of the Louvre gave us an impression of royal dignity, consorting very well with the melancholy grandeur of the ruin of the Tuileries, which stretched, in aristocratic reserve, across its vast garden. Within the last few years, however, all this has been changed. The middle portion of the Tuileries has been swept away, leaving only the two terminal pavilions, guarding, like two sentries, the yawning cavity which replaces the exquisitely sculptured detail of the old palace front. The garden, moreover, across which the ancient façade was seen, has been severed by a wide and busy street, the Rue des Tuileries, on which the Pavillon de Marsan and Pavillon de Flore now directly abut; while, as if to emphasize still more the secularization of the place, the Place du Carrousel has been enclosed by an ugly fence, and filled with sheds and stables for the occupation of the post-office delivery service. In its present condition, the appearance of the whole place would discredit a German village, and it is not surprising that the inhabitants of the most artistic city in the world cry out persistently, though in vain, against it. Many plans have been proposed for filling the void between the pavilions of the Tuileries, and thus completing in some way the façade on the new street, most of them having as a basis the very sensible idea of keeping the new constructions within the limits of a portico or colonnade, relieved in the central part by a larger mass, which could be utilized for a museum or public building of some sort. One of these projects had been so far studied that the central block was already appropriated for a Museum of the Revolution, and the scheme had found general approval when a concise note, as we learn from *La Semaine des Constructeurs*, made it known that the Government looked with an indifferent, if not an unfriendly eye, on the whole matter, and that it was very unlikely that the site of the palace would be surrendered for any such purpose. As the time had arrived for taking some definite steps toward commencing the work, if, as the patriotic citizens hoped, the museum was to be ready to add its attractions to the other incidents of the centennial celebration of 1889, the refusal of the Government to furnish its indispensable aid excited a good deal of indignation, and the municipality of Paris, which does not always submit very meekly to the wishes of the general Government, took up the affair with enthusiasm, and will, it is said, appeal directly to the Parliament of the Republic. In that body its wishes are likely to be heard at least with respectful attention, and it is to be hoped that means may be found for carrying them out. There is no period of history which more needs and deserves study than that of the French Revolution, and it is particularly important that the work of selecting and classifying data should begin now, while documents and objects of all kinds relating to it can be had in abundance, instead of waiting until the most valuable ones are lost beyond recovery.

MÜNTZ'S RAPHAEL.[1]—III.



IN the beginning of Julius the Second's pontificate (1503–1513), there was a dearth of painters in the "Eternal City." Strictly speaking, there was no Roman school till Raphael formed one. The need of the moment was usually met by the importation of foreign artists. Renaissance Rome exploited Tuscan, Umbrian, or Venetian talent, as classic Rome utilized that of Greece. The Roman citizen, as in Virgil's time, willingly delegated to others the pacific glory of the arts. It was the decoration of the pontifical palace in 1507–1508 that drew to the banks of the Tiber the most accredited representatives of the Italian schools: Soddoma, Perugino, Pinturicchio, Signorelli, Lorenzo Lotto, etc., and that initiated the series of monumental decorative paintings which were to be the culmination, the last word, of Renaissance graphic art. Since the reign of Sixtus IV (1471–1484), there had not been at Rome so brilliant a concourse of painters; yet even these elect were forced to abdicate in Raphael's favor. It was, doubtless, owing to the influence of his compatriot, the omnipotent Bramante, that the young painter from Urbino was called to Rome, where he arrived in the month of September, 1508, at the latest. Apparently, he entered at once the service of the pope. The task that Julius II allotted him was by no means the least brilliant. To Bramante was apportioned the rebuilding of St. Peter's; to Michael Angelo, the never-to-be-completed mausoleum and the Sistine vault; to Raphael, the decoration of the apostolic palace.

The character of the impetuous Julius had no small influence on that of the contemporaneous arts, whose grandeur and elevation are, in a measure, attributable to the high ambitions of the warrior-pontiff. Giuliano della Rovere owed his fortune to his uncle's (Sixtus IV) elevation to the papacy. The young prelate was distinguished for his progressive spirit, love of truth, passion for the arts, and a violence that knew no bounds. Devoted and generous to those who shared his views, he was pitiless to his antagonists. Essentially a man of action, Julius did not hesitate to conclude the most compromising alliances, and, on the morrow, to break them. Neither did he shrink, in the days of stress, from ultra-Machiavelian methods. He even took under his wing the infamous Cæsar Borgia, against whom for ten years he had launched the hate of Europe. It was he, too, who decided Charles VIII to make his memorable expedition of 1494 into Italy, the source of endless miseries and complications, of which the effects are even now perceptible. But these contradictions should not blind us to his heroic traits — his indomitable energy, his disinterested efforts for the aggrandizement of the church, and the majesty of his conceptions. Whatever his faults may have been they were entirely free from littleness, from vulgar egotism. The protection he accorded the arts was dictated by a desire to utilize all the intellectual forces at his command for the glorification of the papacy. Hence, the character of grandeur that pervades all his creations, and which contrasts so sharply with the mild elegancies of Leo X's reign. Unlike the latter he had but little taste for literature. He doled out to it encouragements that were lavished on painting, sculpture, and architecture. Artists knew that they could count on his favor provided they were distinguished by some transcendent quality. At his court there was no place for mediocrity. Is it to be marvelled that he cherished Michael Angelo, in so many ways a kindred soul? It may be doubted whether Julius ever had the personal tastes of a Leo X, or well-defined views on art, or a self-formulated code of æsthetics. However this may be, his inspirations were true, and he chose as wisely as relentlessly, remorselessly sacrificing the heroes of yesterday to the celebrities of to-day; Perugino, Soddoma, Signorelli, Pinturicchio, to the rising star from Urbino. Frugal in his habits, and little prone to display, it is not to be wondered that the secondary, or sumptuary arts — embroidery, tapestry, jewelry, and the like — so liberally patronized by his predecessors and so generally encouraged by his successor, languished during his reign. He favored almost exclusively the monumental arts — painting, sculpture and architecture.

The *entourage* of Julius's court was so brilliant, and its enlightening influence so directly manifest in Raphael's work, that it warrants a brief mention of a few celebrities. The College of Cardinals included, among more modest patrons, three great Maecenases — the magnificent Riario, with his escort of four hundred mounted men; the Venetian Grimani, whose superb collections and almost unrivalled library were the admiration of Rome, and subsequently the pride of Venice; and lastly, Giovanni de' Medici, the future Leo X, enthusiastic in his cult of literature and the arts. Besides the sacred college, the so-called *Curia* helped to make the papal court the brightest, the most cultivated and artistic in the world. It was represented by such men as Bibbiena, Bembo, Inghirami, Goritz, Turini; the first two cardinals in embryo, and all intimate friends of Raphael. Bibbiena, diplomatist and man of letters, had a fine appreciation of the arts. He was author of the *Calandra*, said to be the first prose piece of the Italian stage. Nor did this prince of the church occasionally scorn to assume the functions of *impresario* at the pontifical entertainments. Bembo was one of the first *littérateurs* of the Renaissance. His exquisite taste and patronage of the arts were entirely free from vulgar love of display. He formed, at no great personal sacrifice, a collection of marbles, bronzes, gems and medals that was reputed at the time one of the rarest in Italy. Among his pictures were works by Memling, Mantegna, Giovanni Bellini, S. del Piombo and Raphael. Having summed up the brilliant qualities of Inghirami, M. Müntz observes, "What would remain of him to-day had not Raphael immortalized his features in the admirable portrait of the Pitti palace." First among the laymen who frequented the court must be mentioned Raphael's friend of Urbino-days, the all-accomplished Count Baldassare Castiglione, author of the *Cortegiano*, and many exquisite verses, who seems to have been the "perfect gentlemen" of the time. His influence on the young painter was most beneficent, and his advice during the execution of an historical painting equally invaluable. Both the famous Ariosto and the infamous Aretino were known to Raphael. Aretino claimed to be intimate with him; while it appears from a letter, of which the original is unfortunately lost, that Ariosto, then an envoy to the court of Julius from Alfonso of Ferrara, was consulted by Raphael as to choice of personages for the "Disputa." Then, too, there was the great Sienese Crœsus, Agostino Chigi "the Magnificent," with his hundred ships, and as many counting-houses — not in Christian Europe alone, but in Constantinople, in Alexandria, in Memphis, — with his twenty thousand employés; his princely income, and his princely manner of spending it. It is to him that we are indebted for the Farnesina palace and the chapel in S. Maria del Popolo. The artistic band was recruited from all Italy, and above the rank and file towered such giants as Michael Angelo, Bramante and Raphael. Yet not even these great names can obfuscate those of the San Gallo, the Sansovino, and Baldassare Peruzzi, not to mention lesser lights. Thus in the court which surrounded Julius, says M. Müntz, "there was no merit or virtue that was not brilliantly represented: science, talent, nobility and courage, distinction of taste and liberality, qualities of the heart and qualities of the mind, all attained there a degree of splendor that is the despair of posterity, and which was only matched by the enormity of the vices of that pre-eminently ardent and wavering epoch. An equal magnificence may have been seen in other times; but never such a love of intellectual delights. All these painters of fortune — and why not pronounce the word? — all these *parvenus* who constituted the most interesting element of the pontifical court, sought to legitimize their power or their riches by a cultivation of the beautiful; they thus hoped to approach nearer to the ancient Romans, of whom the imitation was, in their eyes, the end supreme." In no other court than that of Rome, a republican despotism — if the paradox may be pardoned — was such a society possible.

Raphael's first work in Rome was the decoration of the *stanza*, called *della Segnatura*. For this he received 1,200 golden ducats, equivalent in the money-power of to-day to about $12,000. The hall was completed in 1511, after three years' labor, not, however, without the interruptions caused by his synchronous easel-pictures in oil, his innumerable designs, architectural studies, etc. Taken as a whole, this *stanza* is the most completely representative of Raphael's development, if not of his talent. In the subsequent *stanze* there may be a distinct advance; in them he is more dramatic and powerful; the flower of his genius has expanded to the full extent of its shapely petals, but for that very reason it is a little nearer its decay, and has lost the ineffable charm and freshness of its blossom-state, we admire isolated figures here and there, we feel that there never were nor ever will be such groups as the wingless young men "excellent in beauty and comely in apparel" fleeting the marble pavement with scourges raised, the fallen Heliodorus, and the horse with the "terrible rider;" or such a figure as the female water-carrier in the "Incendio del Borgo"; or a composition admirable in so many respects as the "Miracle of Bolsena"; yet, as a whole, no *stanza* is more satisfactory than that of the *Segnatura*. In none other did Raphael do so much personal work. In each succeeding *stanza* he worked less and less, owing to his multifarious cares and duties, till at last his actual participation was confined to the preparatory sketches and general direction. In the frescos of the *Segnatura* there is a symmetry, sobriety and purity, the result of a cultivated mind, seeking and pains-taking, well-equipped and capable of expressing itself, but not yet hurried and over-confident. To see how seeking and pains-taking Raphael was at this time, one has only to look at his many tentative schemes for the "Disputa," all so different from the final work. There is a vast chasm between his first Roman fresco and all that had gone before, both as to epic expression and power of composition, as well as individual characterization. Yet every now and then one feels a whiff of the delicious sentiment that emanates from his Florentine madonnas, a sentiment that is scarcely discernible in his later work, save where it occasionally reveals itself, as in the "Madonna del Foligno," or the group of "San Sisto." To be accurate, the "Madonna del Foligno" cannot be classed among his later works, for it was painted in 1511, but it is later by two years than the "Disputa."

At the outset, Raphael had to contend with the technical difficulties of fresco, which are not inconsiderable. He had already acquired some valuable experience while working under Perugino on the frescos of the Cambio, and again at San Severo in 1505, after a long lapse

[1] "*Raphael, sa vie, son œuvre, et son temps*," par Eugène Müntz, Paris. Librarie Hachette & Cie., 1886. Continued from page 148, No. 561.

of time devoted to easel-pictures in oil. If the "Disputa" testifies to a certain inexperience, the "School of Athens" evinces a prodigious surety of handling, that entitles Raphael to be ranked among the first frescoists of all times. A careful examination of the *stanze* frescos by M. Raymond Balze, authorized him to state that the group at the left in the "Incendio del Borgo," composed of four figures larger than life, was painted in six days. In the "School of Athens" "each figure scarcely exceeded a day's work." This of course did not include any retouching "*a secco*," nor the longer time occupied by the cartoon and preparatory studies.

The immense progress made by Raphael after his arrival in Rome must be mainly attributed to his contact with the antique. Such *chefs-d'œuvre* as the Laocoon, the Apollo Belvedere, the Torso, the Ariadne, had already been discovered. The Museum of the Capitol, founded as early as the reign of Sixtus IV, was rich in marbles and bronzes, while the private collections contained priceless antiques. "There was scarcely a prelate, diplomatist, grand seignior, or banker, who did not ardently search for everything which recalled the ancient splendor of Rome: statues, bas-reliefs, gems, medals, and even nscriptions." Then there were the frescos in the Baths of Titus, and the Gardens of Sallust; the triumphal arches of Titus, Septimius Severus, etc.; the columns of Trajan and Antonine; the colossi of Monte Cavallo, and an inexhaustible mine of classical relics, abounding in suggestions. The passion for antiquity was in the air. When to his functions of painter, Raphael added those of archæologist he sent his draughtsmen all over Italy, and even into Greece. This inordinate love for the antique eventually interfered with the personal spontaneity of production, and became an end rather than a means. Raphael had not been insensible to antiquity before his advent to Rome; but like the men of the first Renaissance he translated it into the Umbrian or Florentine vernacular, retaining, perhaps comprehending, but little of the antique feeling. At Rome, the imitation was to be far more direct. There is not much of it in the "Disputa," which still retains the Umbrian-Florentine flavor, though even here it crops out in the chair of St. Gregory. It is very patent, on the contrary, in the "School of Athens" and "Parnassus," which indicate a decided advance on the "Disputa." This advance can in nowise be attributed to the influence of Michael Angelo, for the first half of the Sistine vault was not exhibited — and then to the great disgust of the artist — till 1511 [1] the year in which the *stanza* of the *Segnatura* was completed. At once the receptive Raphael executed the "Isaiah" in the Church of S. Agostino, which was directly inspired by the great Florentine (who was very wroth thereat), as were the "Sibyls" in the Pace, painted in 1514. The subjects that cover the walls and ceiling of the *Segnatura* or "Chamber of Faculties," are most ingeniously conceived and correlated; an interlacement, as it were, of Christian and Pagan myths, of ancient and ecclesiastical philosophies, and the personification of virtues common to both. The literary attainments of Raphael would not have enabled him to expound this complex scheme had he been unable to take counsel with the distinguished men of letters that frequented the court, and with whom he was on intimate terms. Moreover, the personal influence of the pontiff must count for much in the choice, arrangement, and elucidation of the subjects. "The artists of the Renaissance were accustomed to receive from their patrons the indication, generally very precise, of the subjects they were commissioned to represent. Michael Angelo was one of the very few masters who worked out for themselves a scheme for their compositions. It is true that Michael Angelo could pass for a man of letters, but even if he had not surpassed the majority of his contemporaries in this respect, the knowledge of the Old Testament, whence he drew his inspirations, did not exact so special an erudition as the subjects with which Raphael was charged to decorate the hall of the *Segnatura*." It must not be supposed that Raphael was a mere passive instrument in the hands of the savants, for he was well instructed, and thoroughly conversant with the tangible expression of antiquity, and his artist's perception revealed to him many secrets forever hidden to the antiquary; yet it would have been impossible for any painter, certainly of his years and occupations, to be familiar with historical and ecclesiastical history, or with matters of historical detail known only to specialists. It is very much to his credit that he was able to digest these complex ideas, to see them beautifully, and to present them monumentally. These stately, well-balanced compositions are remarkably free from pedantry. In the "School of Athens," he never abrogated his rights as an artist, though depicting definite, historical men and ideas. The noble picture is wholly untainted by archæology, being an epic in itself, not the mere archæological rendering of an epic. In a word, it is no *genre* picture as it might easily have been in less skilful hands, and probably would be if painted by a modern man. Art and archæology can never be identical. The history and myths of antiquity are to us an ideal world, peopled with beautiful, heroic beings. Render them literally, and our fairest creations vanish forever.

It is almost amusing to discover ever and anon in these frescos the prototypes of so many of those stilted academic figures that at one time made art hideous. But the cartoons for the tapestries furnish a far larger quota, and possibly for this reason they are to me less sympathetic. It is a very dangerous thing, be it observed parenthetically, to draw inspiration from a well-ripened art.

Julius died, and Leo X succeeded him in 1513, when the *stanza of Heliodorus* was a little more than half completed. The elevation of Giovanni de' Medici to the papacy opened new fields for the play of Raphael's versatile talents, and was a turning point in his Roman career. Under the grandeur-loving Julius, his powers were concentrated; he was a monumental painter. Under the sumptuous Leo they were scattered. By turns he was painter, architect, archæologist, designer and even sculptor. Leo was as suave and luxurious, as Julius was austere and economical. [The latter's favorite sculptor was in Leo's eyes "*terribile*."] His taste for literature and the arts has already been noted; to which must be added a joyous temperament, a love of pomp and mental pastimes, combined with a prodigality that at times severely strained his exchequer. Never had Italy witnessed so intellectual an epicureanism. Not only the arts and letters, but the sciences music and the drama as well were welcome at the court of Leo, who, however was not oblivious of the Church's interest. To meet the demands made upon it by such a pontiff, it can readily be imagined that the strength of the complaisant and gifted Raphael was sorely taxed. At one time there were cartoons for tapestries to be furnished; at another a scene to be painted; now a platter to be designed, or a defunct elephant to be portrayed the size of life! The great painter's head and hands were at the service of all the decorative arts, — mosaic, wood-carving, gold and silver work, textile fabrics, intarsia, pottery, etc. "If to the models composed for these different industries are added the numberless motives for ornament contained in his frescos and pictures, it will at once be perceived that Raphael occupies a position quite as important in the annals of decorative art as he does in those of painting properly so called."

In the *stanza* of *Heliodorus*, for the first time, Raphael entrusted a considerable portion of the work to a collaborator, Giulio Romano. After the accession of Leo his personal work on the wall was greatly curtailed, and much was delegated to Giulio, to Penni, Perino del Vaga, Giovanni da Udine, and the leaders of the artistic band that the fame of Raphael had recruited from all parts of Italy, and even beyond the mountains. The organization of his atelier was on a vast scale. Were colors wanted, a pupil was despatched to Venice to procure them; another was sent with the "cartoons" to Brussels in order to superintend the weaving of the tapestries; and others, as before noted, to draw in Southern Italy and Greece. The master went abroad with an escort of fifty young painters, a veritable prince of the brush. The frequent abdication of his personal work in favor of his pupils will account for the many strange inequalities to be found in his later paintings, both mural and easel. By the side of his maturest figures and appropriate coloring, are to be recognized the inferior drawing and heavy tones of his disciples. It is impossible to state just how much the hurry of the last few years compelled the reluctant master to leave to his collaborators, but doubtless very much more than is commonly supposed.

Would that I might quote in its entirety Taine's inspired chapter on Raphael in his "*Voyage en Italie*," [T. 1, p. 215], but I must limit my citations to a few disjointed sentences. Referring to the *stanze* he says, "Surely nineteen sight-seers out of twenty are disappointed, and stand with mouths open, muttering, 'Is that all?' It is with these frescos as with the mutilated texts of Sophocles or Homer. Give a manuscript of the thirteenth century to an ordinary reader, and take it for granted that he can decipher it. If he acts in good faith, he will in no wise understand your admiration. I, too, understand that I do not understand. It will take two or three visits to make the necessary abstractions and restorations. In the mean time I am going to say what shocks me: that is, all these personages *pose*." Of the "Transfiguration" he asks, "Has Raphael any faith in his miracle? Above all, he believes that he must choose and arrange his attitudes. The beautiful young woman on her knees is thinking of an effective position for her arms; the three rising muscles on her left arm make an agreeable sequence. . . . Moses and Elias in glory on either side of Christ are swimmers who display their limbs. The Christ himself, with his feet so clearly indicated, his toes separated, is only a beautiful figure; his ankles and insteps have preoccupied him as much as his divinity. This is not impotence, but system, or rather instinct, for there was no system." Again, of the "Incendio del Borgo": "Paltry conflagration and so little to be feared! The fire does not burn; how could it when there is no wood to be consumed. The principal personage is a well-fed young man, hanging by his arms, who finds time to try gymnastics. . . . Two women carry vases and shriek; the caryatides of a Greek temple would have the same movement. I only see there painted bas-reliefs, a complement of the architecture. One goes away with this idea and ponders. To enter into the ideas of a painter one must look at things from his standpoint. And certainly this was Raphael's standpoint. These paintings are not attached to the wall; they are a part of it. They clothe it as the skin clothes the body. . . . The whole Italian painting turns on this idea: it has rediscovered the nude figure. . . . This culture [of the human form and its action] so concentrated will unite all Raphael's faculties on a single point; all the vague aspirations, all the touching or sublime reveries that occupy the leisure hours of a man of genius will end in outlines and movements; *he will think in forms as we think in phrases*." . . . From this point of view, "all his figures are eloquent. They are

[1] C. H. Wilson holds that the first part of the Sistine frescos were exhibited November 1, 1509. In that case Raphael would have seen them about a year after the commencement of the *stanza della Segnatura*. In the "School of Athens," the second of the two great compositions in point of time, one discovers marked traces of Michael Angelo's influence; but these may well have been reminiscences of the Pisa cartoon, or other works that were doubtless to be seen without much difficulty. M. Müntz adduces strong authority for delaying the first exhibition of the Sistine till 1511.

emancipated from the laws of nature; they have never suffered; they cannot be discomposed; their calm attitudes are those of statues. Raphael has given them his soul. . . . Human life is infinite and immensely diversified; but there are only certain portions, certain instants, which, like a rose among a hundred thousand roses, deserve to live, and such are these attitudes." How this brilliant exegesis contrasts with the indiscriminating comments of Vasari, who never seems to have divined the controlling idea of production, but is ever harping on certain superficial characteristics, and these the least remarkable, if remarkable at all. To praise the realistic qualities of the great Italian paintings is to pay them the sorriest compliment.

Reference has already been made in the second paper of this series [Vol. XX, No. 561] to Raphael's preparatory life-drawings and studies. At first he seems to have preferred the silver-point and pen as a means of expression, but after his arrival in Rome, sanguine, and occasionally Italian stone, for isolated figures, reserving the brush for compositions. Though he constantly fortified himself with studies from nature, his drawings were always treated subjectively, and carried just far enough to meet the temporary want. The professional model, fortunately, had not yet been evolved. His preliminary studies for the "Holy Family of Francis I" are most instructive and significant. Let us fancy ourselves, says Charles Blanc, in the atelier of the master. "A young Trasteverina has been led there to serve as a model for Raphael, who is contemplating the Holy Family, now so famous, which we own in the Louvre, 'the Madonna of Francis I.' Clad in a simple tunic, her hair negligently arranged, the young woman, with knee bent and bare leg, inclines forward to lift a child that as yet exists only in the artist's intention. In this attitude she poses before the eyes of Raphael, who, desiring truth before beauty, notes the movement of the figure, makes sure of the proportions, seizes the play of the muscles, and verifies the grace of his thought. But this is only a third of the story. The same young woman will pose again, this time entirely clad and draped, with the exception of the left arm, which will remain bare and afterwards be drawn separately, covered with a sleeve. . . . And yet he knew them by heart, these madonnas with their infant Jesus." There is every reason to believe that Raphael's unrivalled children were the offspring of his imagination. Surely their graceful movements and infantile charm were suggested by domestic scenes, but the forms are distinctly creative. Now that we are on the subject of preliminary studies, it may be said that all the painters of that epoch, who drew figures in positions impossible for a model to hold, made more or less use of models in wax and other mechanical contrivances. According to Lomazzo, Bramante discovered certain *quadrature* of the human body and the horse, "a rare and wonderful invention" by means of which models could easily be fashioned. "These were afterwards given by him to his relative, Raphael of Urbino."[1] It is very strange that there are so few of the master's color-sketches extant. M. Müntz m ntions none, nor have I any personal recollection of them. He probably relied almost entirely on his mental vision for guidance. It is scarcely necessary to add that he did not paint directly from living models, either on wall, panel or canvas.

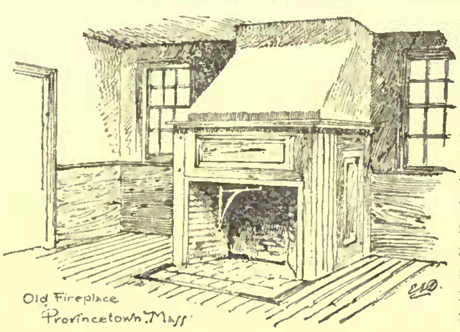
Raphael was cut off so early in his career of architect, that it is difficult accurately to guage his powers. Nevertheless he holds an honorable place in the annals of architecture, though not rising to the height of a Brunelleschi, Alberti, Bramante, or Palladio. "He has the right," says M. Müntz, "to take his place among the masters of the art of building, not only on account of the importance of the works he directed—the continuation of St. Peter's, the completion of the Loggie, the construction of the Villa Madama, and so many others, but also on account of the superior taste he showed in these enterprises. The architect, it is true, was developed later in him than the painter. But towards the close of his life, to gain lost time, as it were, Raphael did not hesitate to sacrifice painting to his new studies." His early penchant and talent for architecture are revealed in the charming backgrounds and accessories of his Umbrian pictures. At Florence these tastes remained in abeyance, but once in Rome, his intimacy with the great Bramante immediately gave them a fresh impulse. It was Bramante, by the way, who designed the beautiful architecture in the "School of Athens." So readily did the pupil profit by the master's lessons, that Bramante designated him as his successor [died 11 March, 1514]. "Seeing," runs the brief of Leo, "that you not only excel in the art of painting by universal consent, but that you have been designated by the dying Bramante as sufficiently skilful in the art of architecture to continue the construction of the temple of the prince of the apostles commenced by him . . ." Then it was that he devoted himself to a profound study of Vitruvius. One cannot but regret Raphael's participation in the building of St. Peter's. According to the testimony of a contemporary, from the day that he succeeded Bramante, "he experienced the effects of a sort of melancholy." Nor were the results proportionate to his efforts. Many years were required to consolidate the edifice, and then the funds failed. Of his secular and private buildings, the Villa Madama, on Monte Mario, and the Palazzo Pandolfino at Florence are generally esteemed his *chefs-d'œuvre*, and are deservedly ranked among the most beautiful buildings of the Renaissance.

Raphael owes his exalted position in the hierarchy of art, partly to natural gifts and partly to the fortuitous conditions of time, place and emergency. Alas, how many god-gifted souls, never quickened by these conditions, forever sleep! Slow to develop, his natural gifts were supplemented by close application. "From my earliest childhood," he said, "I have made it a rule to neglect nothing." [Passavant, vi, p. 246.] Decadence set in when his pupils substituted formulas for an ardent initiative. At Perugia he acquired warmth of coloring and intensity of religious sentiment; at Florence, greater technical skill; at Rome "he felt the force and joy of paganism." He was fortunate in that he was rarely crossed, and never pinched. Work of the most inspiring kind, that would have elevated even a mediocre artist, came to him fully equipped when he needed the stimulus of responsibility and the exercise of his faculties, which would otherwise have perished from inanition. It came, too, when art was at its zenith; when, after centuries of husbanding, the fruit was ripe. Raphael was not an isolated figure like Michael Angelo — who was as isolated as a man can be — but a *résumé* of all that was and had been. Pages might be devoted to his personal characteristics — to his courtesy, his amiability, his tranquility of soul in an age rife with passion and violence; for heaven, says the Italian biographer, had accumulated on him all her blessings. Yet there is one trait that must be especially emphasized, the key-note of his inspiration, and that is his love of beauty. For an eloquent and pathetic tribute to his character and talents I must refer the reader to Vasari's eloquent peroration: "*O felice e beata anima*. . . ."

M. Müntz is certainly to be congratulated on his scholarly, well-ordered and thoroughly readable book. It is a cyclopædia of Raphaelesque knowledge, pleasantly free from sterile disputations and a vain show of erudition. If there is anything to be criticised, it is the picturesque enthusiasm of the biographer for his hero, that, in the absence of authority, at times leads him to assume too much. For instance, his theory (based merely on the accidents of pose and technique) that Raphael, when portrayed by Marco Antonio (p. 659) was experiencing the symptoms of his fatal malady appears to me very fantastic. As to the cause of Raphael's death, neither Passavant nor M. Müntz adduce convincing reasons for discrediting Vasari, whose version is not irreconcilable with the contemporary letters of Michiel, Mirandola, or the envoy from Ferrara. But this is a mere matter of detail, and a very questionable one. It would seem ungracious to find the least fault with a work so monumental — a generous and worthy tribute to the memory of the great painter.

FREDERIC CROWNINSHIELD.

BIRMINGHAM TRADES EXHIBITION.



IN connection with the British Association visit to the midland capital of England, an exhibition was arranged in Bingley Hall to illustrate the industrial resources of the workshop of the world, admission being restricted to a radius of fifteen miles from the town-hall. Notwithstanding the limited area, the products of no less than two hundred and fifty distinct trades, special to Birmingham, may be counted.

By the present imposing display, the town has fully redeemed its character for turning out "Brummagem" ware, and it has proved that good and conscientious work may be produced provided a fair price be obtained. The exhibition has come quite as a surprise on account of its richness and variety, while the popularity it at once secured was also unexpected, so much so that the doors will, at any rate, not be closed before the end of October.

To lend additional interest the archæological section of the Birmingham and Midland Institute has contributed a series of sketches and photographs of old streets and buildings in Birmingham, most of which have now been removed. Moreover, on the north and west sides of Bingley Hall, where the exhibition is held, are reproductions of old Birmingham houses, designed by Mr. J. A. Cossins, and erected by Mr. G. H. Bernasconi. They include the interior of an alchemist's laboratory, with all the traditional accessories, and tenanted for the nonce by a well-known Birmingham man, dressed in antiquated garbs, whose keeping-up of the character caused no little interest during the conversazione in connection with the British Association Meeting. A series of helmets, some of them fearfully and wonderfully made, worn by the Birmingham Fire-Brigade since it was first established in 1710, excite the wonder of beholders. A collection has also been got together of old books printed in Birmingham between the years 1757 and 1873, with type and matrices for the University Press at Oxford.

One room is set apart for all the drawings that could be collected actually made by James Watt, the inventor of the steam-engine, who lived and worked at Handsworth, near Birmingham, where the works started by him are now carried on by Boulton & Watt. Some of the old handicrafts of the district, now fast dying out before the march of improvement and machinery, are practically represented. There is the gold-beater laboriously hammering out between skins his fine

[1] *Idea del Tempio della Pittura*, ed. of 1785, p. 14 (original ed. 1571).

film of gold, ever and anon changing his double-headed hammer from one hand to the other; but he will not be disestablished just yet, for no mechanical process has been found to give the same result as his dull "thud, thud, thud," upon the yellow metal. A man, woman and boy are making nails by hammer on small anvils supported on barrels. They take two slit rods from the fire at once and forge them at the same time, giving a blow alternately to each. Their hard labor from early morn to dewy eve barely suffices to keep body and soul together; and this is easily explained by the large and varied collection of machine-made nails sent by Felix Hadley, whose automatic machines, six of which are tended at once by an unskilled hand, produce an almost incredible number from the strip of sheet-iron. The trophy of Nettlefolds — name almost synonymous with screws — shows, too, the great variety of similar articles that can be turned out by millions in the machine. The file-cutter is producing, before the eyes of visitors, the furrows in his steel bar laid on a leaden bed, with broad chisel and mallet. But, though the cuts are remarkably regular while they succeed one another, there is a manifest break of continuity when he lifts his hand to shift the steel. He, too, will soon find his occupation gone, except for special forms, in presence of the machine-made article, now nearly, if not quite, as good as that produced by hand.

Bell-founding is illustrated by the formation of the mould in sand from the pattern. The spurrier, an old Birmingham handicraftsman, who of yore had his guild, is still forging spurs for the lieges. While an ingeniously elaborate machine weaves wire-gauze for safety-lamps, etc., wires are, strangely enough, being woven by a girl's hand into fire-guards. The old style of weaving by the hand-loom is shown, side by side with the new, and the Steven-graph ribbons that were invented by a philanthropist, possibly injudicious, to prolong the dying trade of the Coventry ribbon-weaver, grow in the special loom with more or less artistic representations of persons and things. A practical illustration is given of hand brush-making, the principal difficulty of which appears to be judging the exact quantity of hair, bass, or bristle for filling the hole in which it is fastened by pitch. A resource for the blind is found in chair-caning and mat-making, in which they soon become very expert.

Specimens of the Staffordshire blue bricks, and of the famous Stourbridge fire-bricks, are on view in various stages of manufacture, with the respective clays from which they are made. Hopkinson & Co. show varieties of their revolving partitions, which have been adopted by the Birmingham School Board. They consist of red deal slats, strung on copper bands, like revolving shutters, and rolled up into a box under the ceiling, while the grooved uprights may be removed with little difficulty. The object is to readily convert a large school into class-rooms when required; and it is said that these movable partitions cost less than fixed wooden partitions. John Parker sends from his steam joinery works a fifteen-inch pitch-pine log, with fluted sides and the top handsomely moulded, to show what large stuff may be dealt with by modern wood-working machinery. He also exhibits the lower portion of a pitch-pine staircase, with ornamented newel and moulded handrail in walnut, square-turned and fluted balusters, string with solid sunk panels, and spandrel and dado panelling to match, all done by machinery, hand-labor being reduced to putting the stairs together. Henry Hope sends ornamental wrought-iron casements — a specialty.

Jones & Willis, who make the 50-candle "Hesperus" lamp to burn petroleum, with three wicks arranged in the form a triangle, have an attractive stand of art metal work, woodwork, embroidery and textile fabrics, as used in the service of the Church of England. Hart, Son, Peard & Co. show a replica (not, however, so elaborately chased) of the "angel" lectern they made for the Philadelphia cathedral. Though eagle lecterns are common, it appears that only these two "angel" lecterns exist. This firm has brought out a perfectly original and exquisitely beautiful vase that will not break: the foundation is of sheet-copper, polished and left its natural color, when it soon assumes various hues from oxidation by the air. The ornaments are sprays, beaten out by the hammer from black iron, copied from the hop, ivy, etc., no two being alike.

There are two exhibitors of high-art furniture: Chamberlain, King & Jones have a richly carved Renaissance sideboard and chairs in pollard oak, the dead ornament showing in fine contrast with the polished moulding, and also an example of pure Adams style in an inlaid rosewood cabinet, settee and writing-table. Morris and Norton have put up a pavilion, with dining-room furniture in pollard oak, drawing-room ditto in rosewood, inlaid with various woods — the finest work of the kind executed in Birmingham — and two bedroom suites, one in rosewood and the other painted white.

Tonks & Sons, whose name is identified with improved house-fittings, not unknown in the States, have a whole exhibition to themselves; and it is difficult to do them justice in a few lines. They have on view Carroll's ventilators, which admit the outer air through an adjustable aperture in the bottom rail of a door, giving it a vertical direction for avoiding draughts. They have a handy means of raising and lowering a heavy upper sash with next to no effort. Their metallic sash-cord wears well without wearing out, avoiding the nuisance of a broken cord and fallen counter-weight. Their blind furniture makes a blind stop where it is put. Their patent bolt seems to go into its socket all by itself, avoiding the necessity for that humoring which is so annoying when one is in a hurry. Their door furniture is simple and effective, so simple that the chances are remote of its getting out of order. For unsound plaster walls, they have a neat escutcheon, fixed by three small pins, and carrying a curved socket, through which picture-cord is passed, the friction facilitating the adjustment of the picture, and preventing its being placed awry accidentally. Their iron book-shelf strips, to receive the shelves at heights varying by about an inch, must save a great deal of time and expense in fitting wood strips for a similar purpose.

A variety of household requisites stamped out of sheet-iron and tin plate are shown by J. H. Hopkins & Sons, who finish them with their new "stannic enamel," which gives them a semi-matt morocco leather appearance, well suited to the present taste. The articles are painted over with the specially prepared enamel, then rolled while still wet, by a roller coated with some glutinous composition, something like those used for applying printers' ink to the types; but in parts where the roller cannot reach, the enamel is dabbed with a dabber. This produces a uniformly granular surface, very pleasing when in semi-tones relieved by gold ornament; and it is fixed by baking the articles in a stove like that for japanning. British Association visitors saw the operation in progress at Messrs. Hopkins's works.

The centre of the exhibition is occupied by a light-house, with revolving, dioptric lenses, specially arranged for the electric arc, erected by Chance Bros. & Co. It flashes every ten seconds, making a complete revolution in two minutes, and having shades of red and green to vary the effect. Mr. and Mrs. Goold, of Milverton House, Knowle, contribute a "regulator clock of many nations," supposed to be without its fellow in the world. There are twelve dials working from one central movement, surrounding a large one which gives Greenwich time, and also a seconds' dial and a solar dial, the latter revolving while the pointer is stationary. The hours of New York, Paris, Sydney, Madras, Calcutta, Canton, St. Petersburg and Constantinople are shown simultaneously. The escapement is "Graham's dead beat," with no recoil, invented one hundred years ago, but not yet superseded. T. Wilkinson & Sons show something new and agreeable in Perry's sweet resonating gong, which consists of a hollow circular metal vessel, with lipped mouth, generally resembling a gong, and hung freely: when struck in the ordinary way, it gives out a melodious sound, varying in tone with the note to which it is tuned. Several of them are hung together in a frame, to form a gong-chord, and competent musicians are of opinion that this will form a valuable addition to an orchestra.

What must come as a boon and a blessing to women is a sewing-machine motor, devised by W. Bown, the inventor of ball bearings for tricycles. Two minutes' not laborious winding-up of a spring will keep the machine going for an hour, while the speed may be regulated at will. A. Shirlaw & Co. show, running, Spiel's petroleum engine, which draws its supply from a tank by a centrifugal pump, thus obviating any handling of the oil, and utilizes it in a fluid state, at about a pint per horse-power per hour. The engine may be started at any moment, and comes to rest when the supply is exhausted, requiring no attention. Tangyes, limited, exhibit in action their gas — not steam — hammer, giving 2,500 blows of 3 cwt. through one foot, for the small charge of one penny.

Muntz Metal Company show a 1,000 foot coil of small copper pipe, without seam, drawn perfectly parallel from end to end by Sharp's patent process. The processes of steel-pen making are illustrated by Perry & Co., who have also brought out Appleby's new drive-chain. This consists of square links, connected by v-shaped links in such a way that each link is readily detachable, and yet is held firmly and with great side support, to prevent stretching. S. Alcock & Co., who have a branch establishment at Toronto, show a great variety of fishing-tackle, the best rods being now built up with six segments of the same or different woods, so as to secure straightness of grain. Henry Milward & Sons, the largest needle-makers in the world, whose works at Redditch were visited by members of the British Association, show a great variety of this universal tool, which passes through at least twenty-six distinct processes, notwithstanding the introduction of much automatic machinery to facilitate the operations.

J. W. P.

THE ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

THE ROTCH TRAVELLING SCHOLARSHIP DRAWINGS. — PLATES XXVIII, XXIX, XXX.

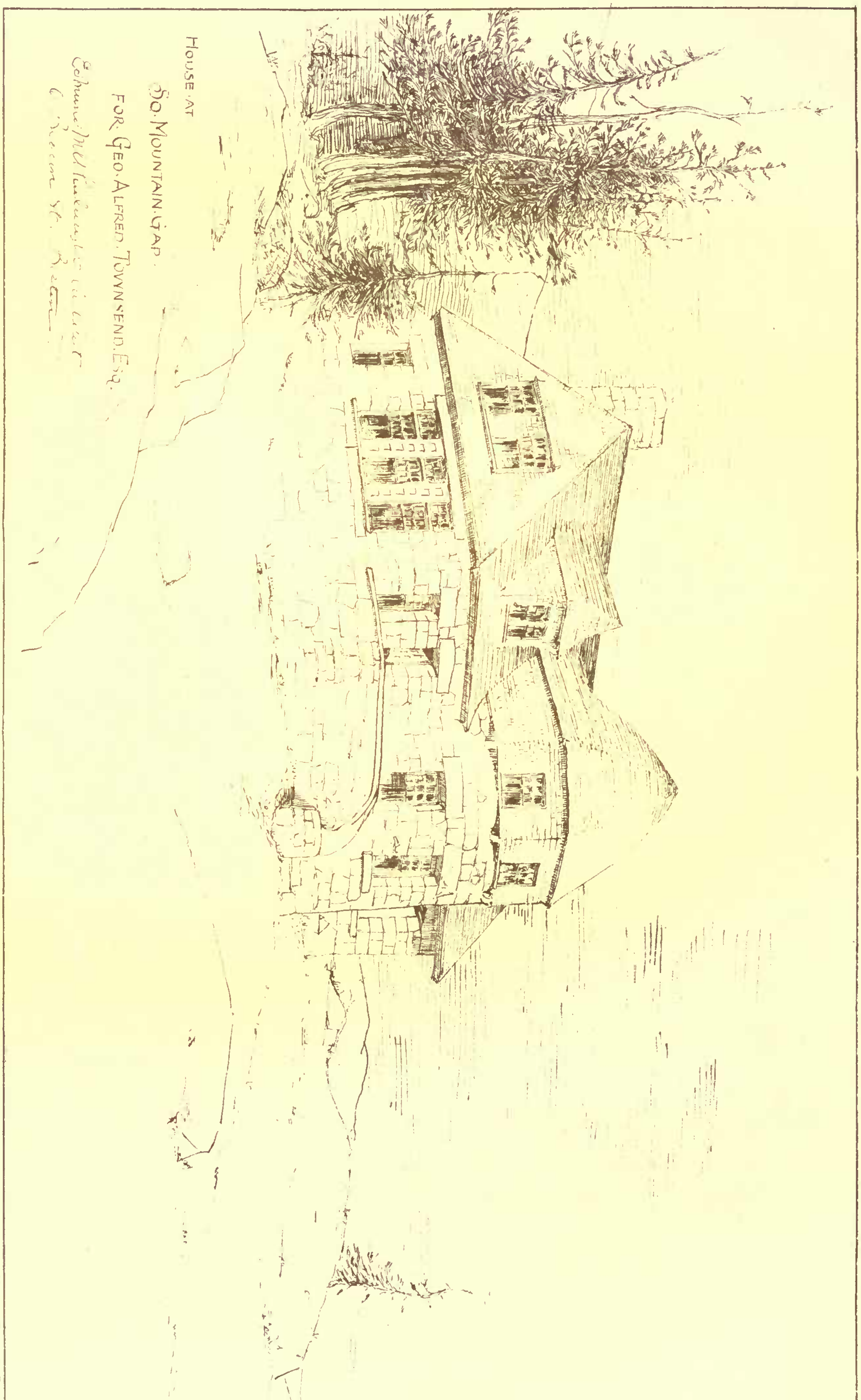
[Issued only with the Imperial edition.]

BUILDING FOR MESSRS. EIMER & AMEND, NEW YORK, N. Y. MESSRS. DE LEMOS & CORDES, ARCHITECTS, NEW YORK, N. Y.

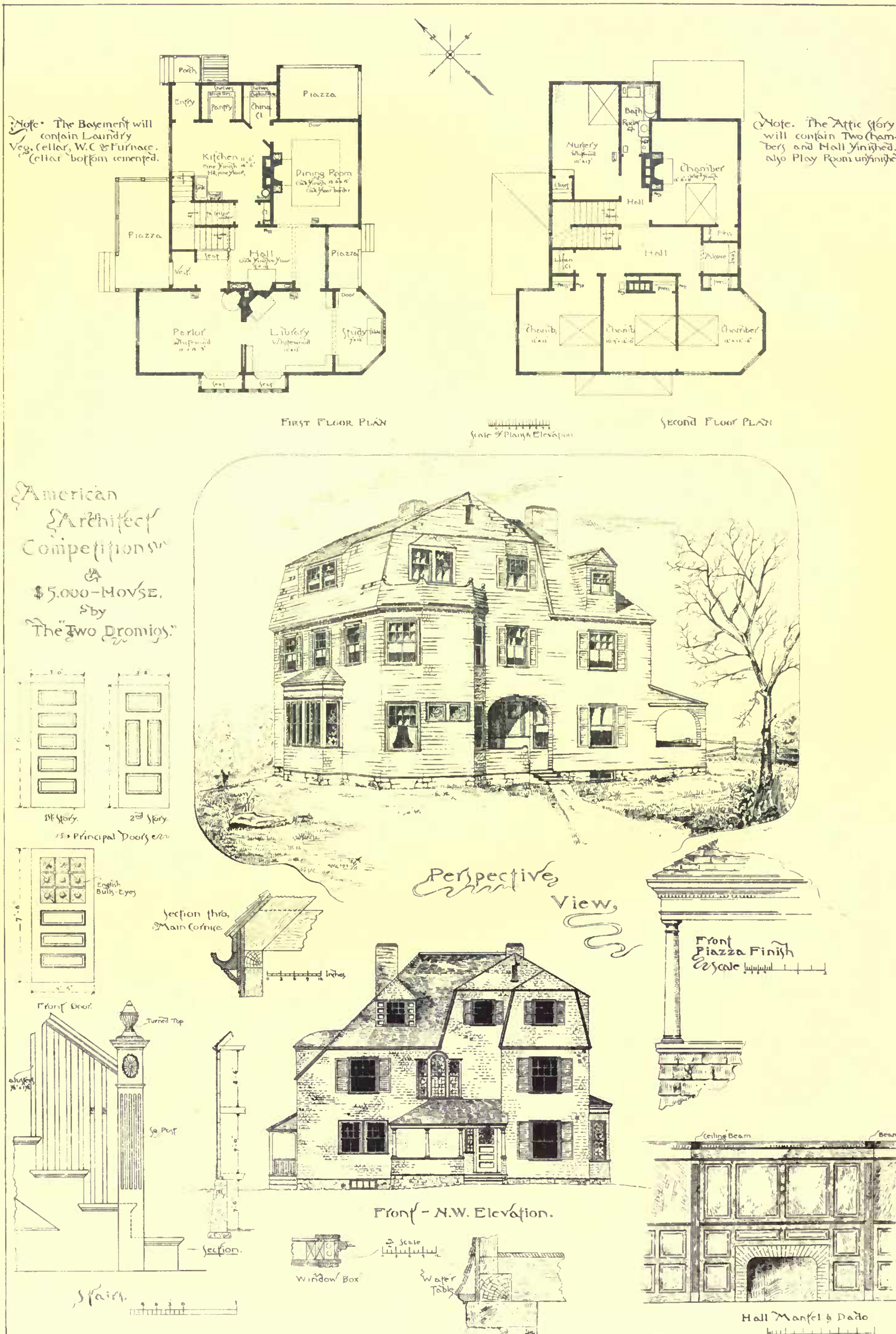
This structure is intended to be fire-proof throughout. The interior of walls of first and second stories is lined with white enamelled tile. Cost of building, including store fittings, $120,000.

CHAPEL FOR HOLYHOOD CEMETERY, BOSTON, MASS. MR. T. O'GRADY, ARCHITECT, BOSTON, MASS.

HOUSE AT FALMOUTH, MASS., DESIGNED FOR HIMSELF, BY MR. FRANK HILL SMITH, ARTIST, BOSTON, MASS.



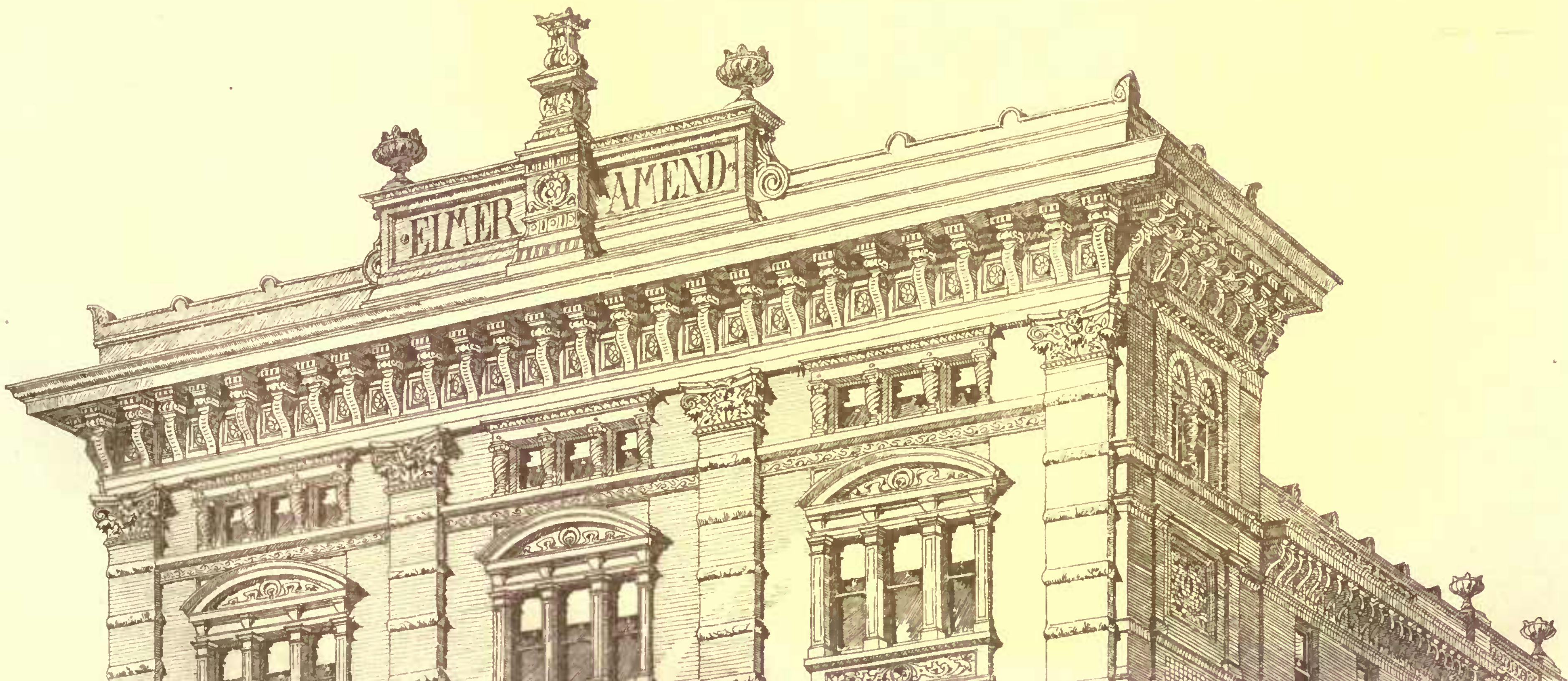
Heliotype Printing Co. Boston

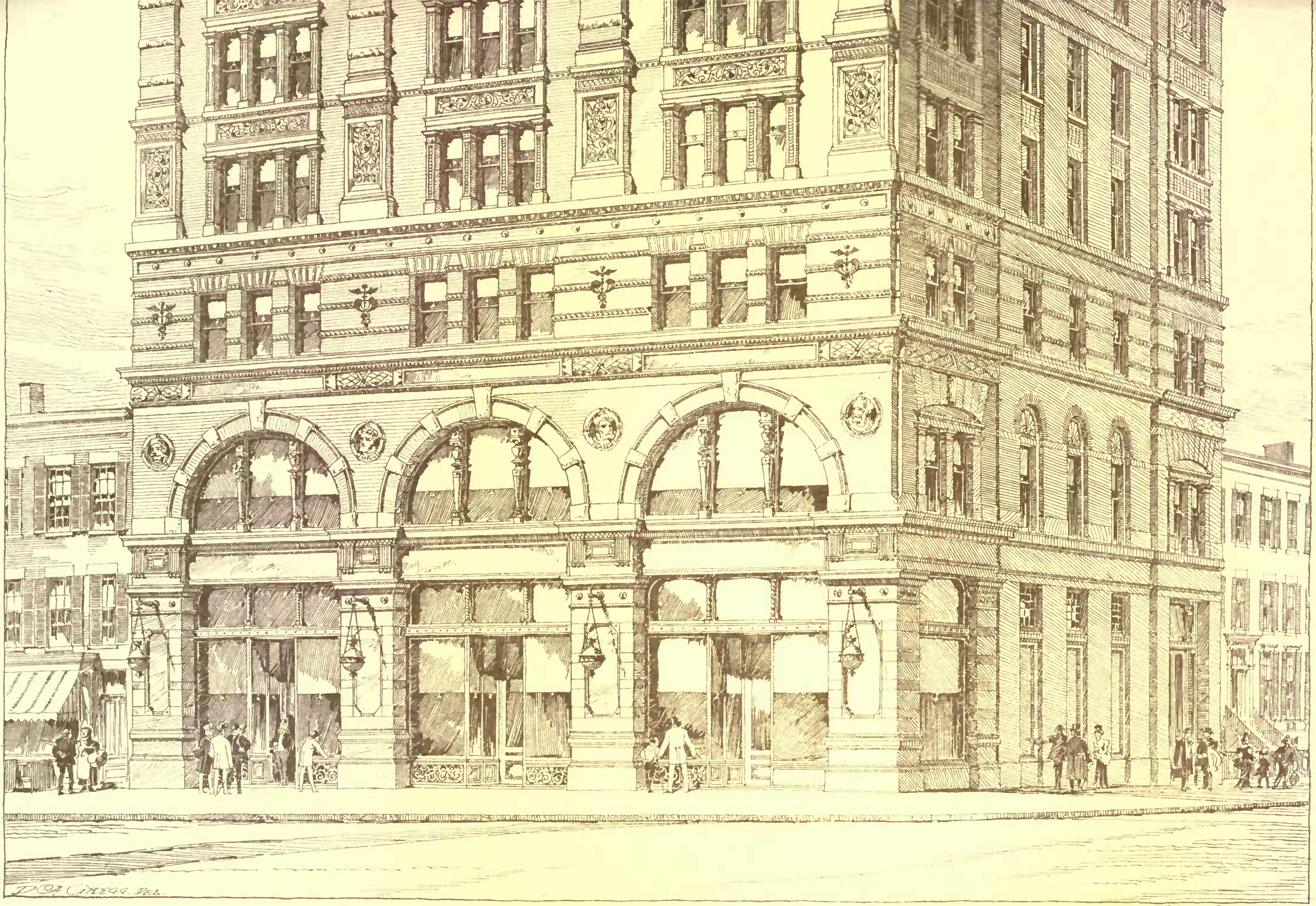


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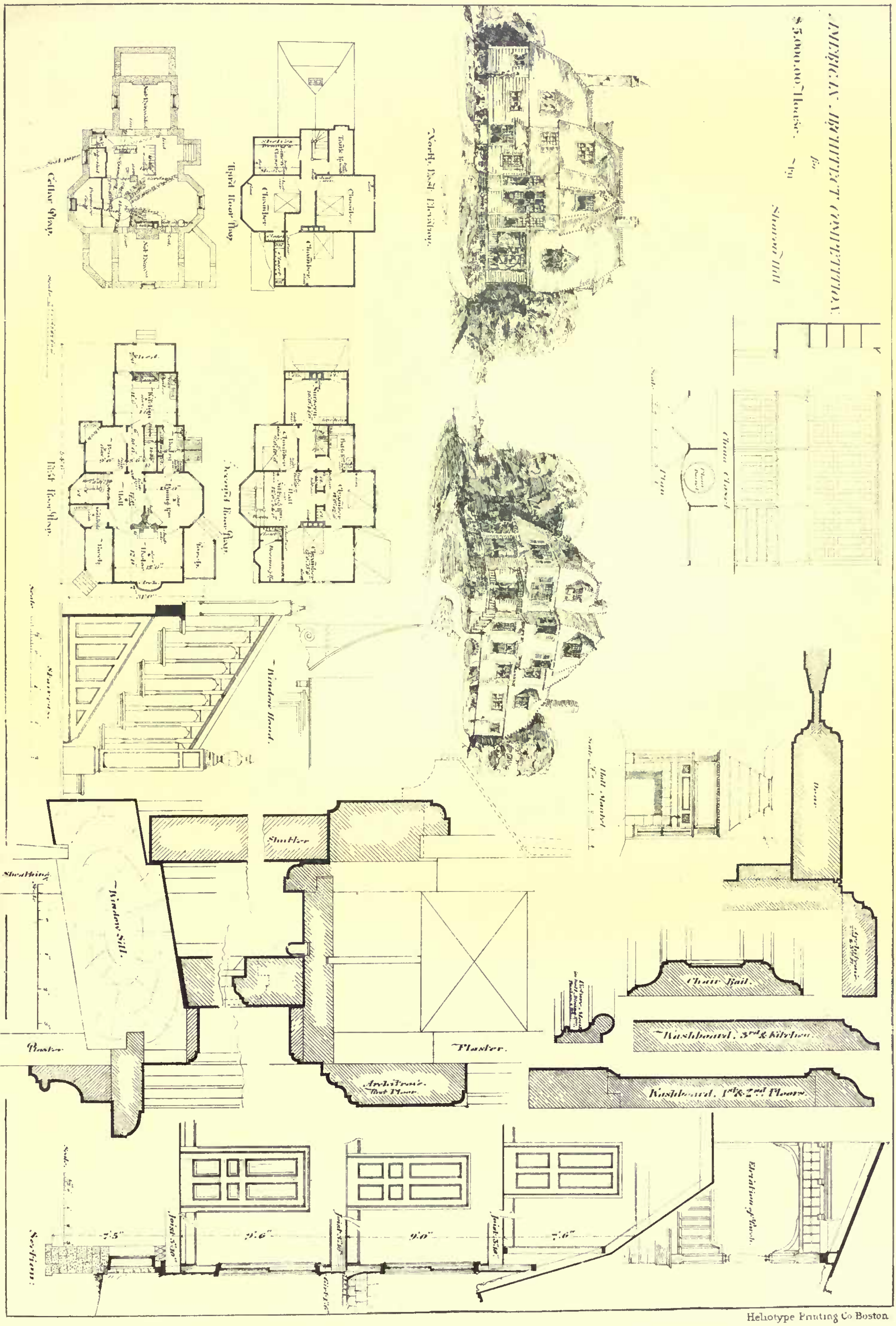
Building for Messrs. Eimer & Amend,
3d. Ave. and 18th. St. New York.

Messrs. De Lemos & Cordes, Arch'ts.
New York.

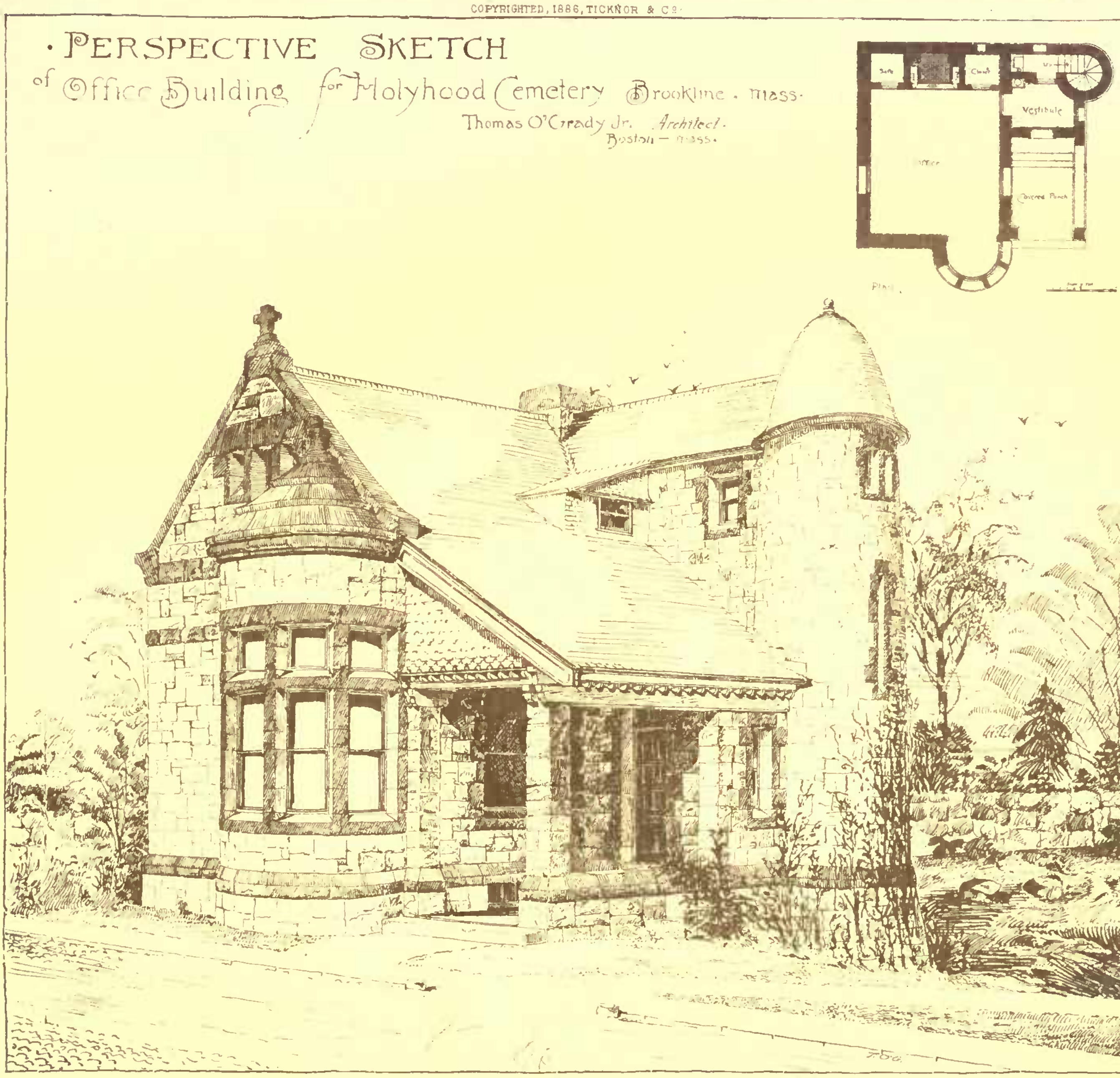


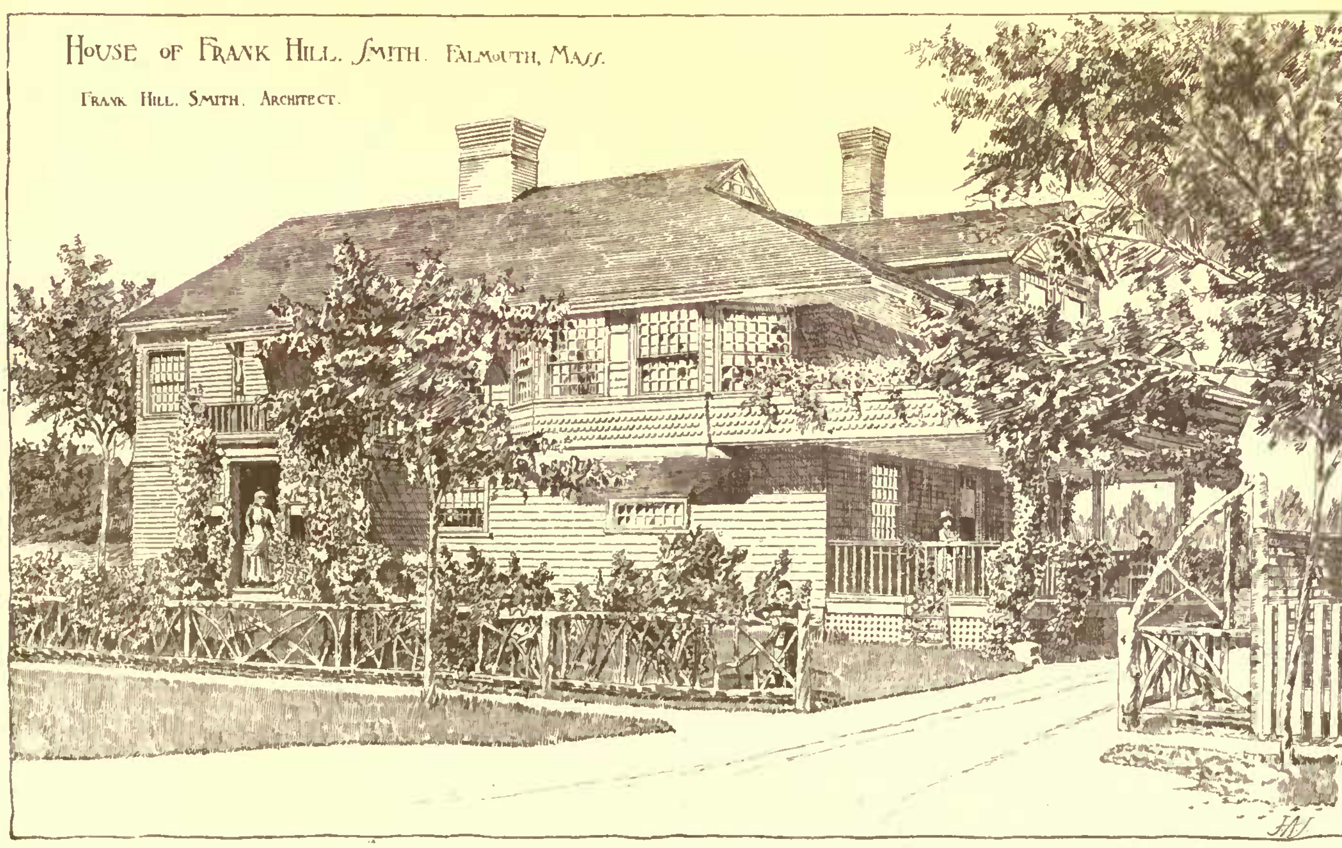


Heliotype Printing Co. Boston



Heliotype Printing Co Boston





Heliotype Printing Co Boston

COMPETITIVE DESIGN FOR A $5,000-HOUSE, SUBMITTED BY "*Sharon Hill.*"

MASONRY.	
Preliminary,	$10 00
Excavation,	30 00
Foundations,	363 00
Hatchway or area,	24 50
Chimneys, mantels and grates,	440 00
Lathing and plastering,	350 00
Cellar bottom,	15 00
Miscellaneous, stone sills,	4 20
Total of masonry,	$1,236 70
CARPENTRY.	
Frame,	$395 00
Frame covering,	225 00
Roof,	480 00
Windows,	275 00
Dormer windows,	58 00
Veranda,	35 00
Cellar windows,	35 00
Bay window,	290 00
Floors,	85 00
Doors,	225 50
Stairs,	262 00
Wainscoting and base,	50 00
Pantry and butler's pantry,	40 50
Kitchen sink, etc.,	13 50
Tank,	25 00
Bath-room,	25 00
Water-closet,	16 50
Dressers,	21 00
Cold-air duct,	15 00
Coal-bins and partitions in cellar,	19 00
Fences,	100 00
Miscellaneous,	100 00
Painting,	450 00
Tinning, slating, and galvanized-ironwork,	15 00
Plumbing and gas-fitting,	458 00
Total for house,	$4,950 70

COMPETITIVE DESIGN FOR A $5,000-HOUSE, SUBMITTED BY "*Two Dromios.*"

HOUSE FOR GEORGE ALFRED TOWNSEND, ESQ., SOUTH MOUNTAIN GAP, MD. MR. E. M. WHEELWRIGHT, ARCHITECT, BOSTON, MASS.

A CORRECTION.

WE are requested to state that the "design for a panel and border," shown in one of the plates illustrating the work done by the students of the class in decoration at the Museum of Fine Arts, which were published in our issue for October 9, was the work of Miss M. C. Sears, and not of Miss Goldthwaite, as stated.

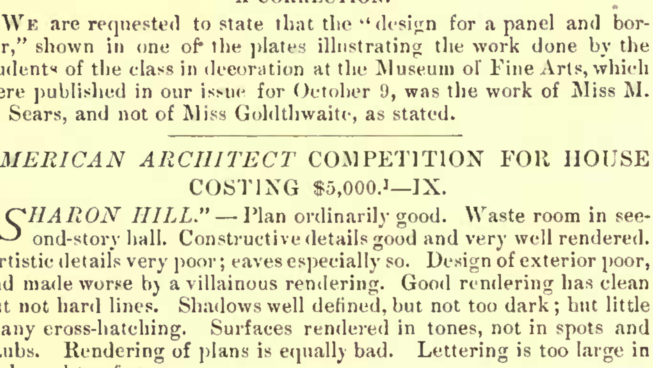
AMERICAN ARCHITECT COMPETITION FOR HOUSE COSTING $5,000.[1]—IX.

"*SHARON HILL.*" — Plan ordinarily good. Waste room in second-story hall. Constructive details good and very well rendered. Artistic details very poor; eaves especially so. Design of exterior poor, and made worse by a villainous rendering. Good rendering has clean but not hard lines. Shadows well defined, but not too dark; but little if any cross-hatching. Surfaces rendered in tones, not in spots and daubs. Rendering of plans is equally bad. Lettering is too large in scale and too fussy.

"*Cragside.*" — Waste room in halls. Dining-room inconvenient. Kitchen is small. Details throughout poor and thin. Exterior very poor. Square bay placed diagonally on corner is always bad, and especially so when surmounted by a useless and ugly canopy. Lack of mouldings and atrocious method of hooding window in peak of roof makes it look like a window in a tin house. Lettering very bad. Rendering coarse, uneven, unskilful and disagreeable.

"*No Shade*" is true to his motto and sends a design with outlined perspective without shadow — a wasteful planned house, with poor proportions and details.

THE TIMBER MANOR-HOUSE OF LANCASHIRE AND CHESHIRE.



POMPEIIAN KITCHEN.

IN the days when the Scots were wont to come harrying through the plains of Lancashire, and when the Welsh were threatening across the Cheshire borders, it was a needful thing for a gentleman of either county to make his homestead in some place of vantage against the invader. If it happened that a hill rose from the level, or there was a favorable bend in the river, the position of the house was decided; but when nature did not lend herself to his defences, he built it still as stoutly as might be, and fenced it around with an open moat, and gave admission generally by a drawbridge only. Stone was scarce and difficult to procure, except in the hilly country to the northeast; so the basement alone was built of it, and the superstructure was framed in gigantic beams of oak, placed at intervals, and with a view to effect, the spaces between them being filled in with wicker-work, covered with clay and afterwards with plaster. Lancashire and Cheshire were richer in this "magpie" or black-and-white half-timber work than any other district of England, and they may be proud of the numerous examples of it which they yet possess. Often in the suburbs of some busy centre of the cotton industry wil a quaint old mansion be found amongst the cottages, smoke-begrimed like them, and falling into misery and decay; and again, far away in the country, where the cattle stand up to the flanks in the long grass, and a cornfield stretches behind, we see the picturesque gables peeping above the hedgerows, and there are pigeons strutting about mediæval dovecots. Some of these manor-houses are preserved fittingly by owners who value them; but, too often,

> An orchard, and a moat, half dry,
> Remain, sole relics of a power passed by,

or the house is utterly defaced, or has fallen into decrepit and picturesque decay.

These manor-houses, when they had any pretensions to importance, were never built on an ordinary rectangular plan; they were E-shaped, L-shaped, or quadrangular, but the quadrangular mansion, surrounded by a moat, may be taken as the best type. Leland describes Morley Hall as standing upon a stone basement which rose six feet above the waters of the moat, and as otherwise "al of tymbre after the commune sort of building of Houses of the Gentilemen for most of Lancastreshire," and, he might have added, of Cheshire, too. In mediæval times, from before the year 1300, the moat was usually crossed by a drawbridge, which, in the Tudor period, was occasionally replaced by one of stone. In the waters below grew the *acorus calamus*, or sweet-flag, a pleasantly-scented reed, which was used to strew the floors of the chambers within. Entering the building beneath the archway, the visitor found himself in a quadrangular court-yard, where often yew-trees grew, as at Speke, and where sometimes a sun-dial stood. The domestic offices and dwelling-rooms which surrounded him were generally painted black and cream-color, the timbering being very ornamental in places, and the irregular distribution of the gables and roof-trees gave a very charming sky-line. Opposite to him would be the great hall, with its characteristic projecting bay, and the lord's chamber, and, near them, the kitchens, with the buttery and pantry; the withdrawing-room and dancing-gallery might be on one hand, and the domestic chapel and priest's room on the other; then there were the servant's apartments, the bed-chambers and other domestic offices. The great hall was the principal chamber of the house, where the lord kept up his state with his retainers about him, and where he gave great hospitality both to strangers and to friends. It was entered from a passage leading from the court-yard through an archway in a carved-oak screen, and the aspect of the interior was usually very fine, for the hall was sometimes nearly fifty feet long and about half as wide, and it might be larger. Some of the later halls have flat ceilings; but the open-timber roof is the better type, and some very admirable examples of it yet remain, as at Rufford, where carved angels support the shields, and at Baguley, where the work rests upon wooden arches and pillars, the spans being filled with open trefoil tracery. At the far end of the hall stood the lord's high-table upon a daïs, with a carved canopy over it, and there he sat with his family and friends, while the retainers were in the space below. The lord had a great projecting bay near him, which had seats in it, and served almost as a drawing-room; and the musicians were placed in a minstrels' gallery constructed over the entrance-passage at the far end of the hall. Near the lord, also, was the immense arched fireplace, with its ingle-nook, where he could sit when the wind blew cold without. All these are features illustrated even now in very many of the existing manor-houses of Lancashire and Cheshire. The smaller hall, or lord's chamber, was entered from the daïs, and was an elegant room where the family sometimes dined in private, especially when the great hall was cold and draughty in winter. It was a pleasant place in summer, too; for it often had a bay projecting into the garden, with a doorway, a feature sometimes very picturesquely treated, as at Ordsall, near Manchester, where the door is placed between the small *vis-à-vis* bays. The ladies' withdrawing-room was close at hand, and was an apartment of considerable elegance, often, in later times, with an elaborate plaster ceiling, divided into panels by carved beams, the panels, as at Speke, being enriched with fruit and flowering shrubs in high relief. The most elaborate example of plaster-work in Lancashire is probably at Astley Hall, near Chorley, where the pendentives are cherubs in the Italian taste, which would doubtless fall if lead had not been used in their construction. The largest of the apartments on the second floor, reached often by a circular staircase, was the gallery or dancing-room, where one may picture many a gay scene of stately dance when the neighbors came together, and may fancy yet that the echoes of mediæval music linger. At the last-named hall, which indeed was partly reconstructed in Jacobean times, a good example of the dancing-gallery remains, with its windows and bays extending the whole length of the façade, some seventy-two feet in all. The chamber is panelled in oak from floor to ceiling, and quaint, tall-backed chairs stand against the wall, with carved presses and cabinets of great richness. But the most interesting piece of furniture in the room is an ancient shovel or shove-groat table, very massive in its framing of oak. "Hit him down, Bardolph, like a shove-groat shilling," says Shakespeare in allusion to the game that was played upon it. The remaining portion of the upper floor of these north-country manor-houses was usually occupied by the bed-chambers, which had a pleasant outlook into the court-yard, or at the great barns and stables, or over the moat at the yellow cornfields beyond. The domestic chapel, which often formed a picturesque feature in the main building of the house, stood sometimes

[1] Continued from page 158, No. 562.

apart, and was occasionally placed beyond the moat. In nearly all these houses hiding-holes exist, or the traces of them, especially in those built or reconstructed in Tudor times, when recusants were hunted for, of whom there were plenty in Lancashire and Cheshire. A good example of the hiding-place may be traced at Moreton Hall, where two apartments are entered by a sliding panel, and where an arrangement in the floor enabled a fugitive to reach them from the farthest end of the house. The farm-buildings of the manor-house stood apart, perhaps in a separate quadrangle or at a little distance from the main edifice, the chief being the great barn, erected on a church-like plan, with nave and aisles, and sometimes, as at Ordsall, with transepts also.

Such a building as is here sketched is a fine example of the mediæval dwelling-place, where the lord lived with his family and adherents, at peace with all except such as the drawbridge excluded. The community needed little help from without; for it had corn-land enough for its wants, and there were pastures where the kine fed and the sheep fattened; then there were dairies, barns, and stables in abundance, and the lord had hawking enough for his entertainment. Besides, it had its domestic chaplain, who not only ministered in religion, but was also the instructor of its youth and the custodian of such a library as it possessed. It is not unnatural that a certain independence should have been engendered in the lord of such a household; and, as a matter of fact, he did sometimes carry things in a somewhat high-handed manner with his neighbors, though, on the whole, he was placable and patriotic, as became him, and he had many kindred about him, so that he was felt to be a power in the State. When need was, he would go forth with his men-at-arms and his bowmen and spearmen in his train, and do many a doughty deed in his country's battles. His name was recorded amongst the victors at Cresey, Poictiers, Agincourt, and elsewhere; and he fought and suffered for the Red Rose of Lancaster. It is not surprising that the house he inhabited should have become the centre-point of many a legend and story, or that its panelled chambers and mysterious hiding-places should be deemed to have tenants other than those of the flesh. Perhaps, as at Samlesbury, there may be some strange story of witchcraft told of it; or, like Kempnall, it may heretofore have been inhabited by demons; or there may be a mysterious skull in its chambers, as at Wardley, where the Tyldesleys dwelt.

One of the most interesting timber manor-houses in Lancashire is the very characteristic one of Speke, near Liverpool, built by Edward Norreys, in 1598, and whose hall is enriched with a wainscot, probably brought, with other treasures, from Holyrood by Sir Edward Norreys, who fought at Flodden Field. Here we have the quadrangular structure, with the quaint gables and the yew-trees overshadowing them, and the encircling moat, now dry, crossed by a bridge of stone. Ordsall, already alluded to, the ancient residence of the Radcliffes, although sadly decayed, is distinctly noteworthy on account of its magnificent great hall and its characteristic barn. The ancient hall of Smithills, near Bolton, will excite the interest of many visitors, because of its old-world aspect, its quaint panelling, its curious carvings, and its glass; and the celebrated Hall i' th' Wood, not far away, with its mixture of picturesque woodwork and weather-stained stone, and its story of Samuel Crompton, with his "mule" concealed in its attic, is scarcely less interesting. This district is, indeed, rich in remains of timber architecture; and the Halls of Great Lever and Little Bolton, as well as Tyrton Tower, all deserve much notice. Rufford Old Hall is another admirable example of the Lancashire manor-house, picturesque in its wood and plaster, and filled with the most elaborate carving internally. Samlesbury, near Blackburn, built about 1548, by Sir Thomas Southworth, has a hall with a very fine timber-roof, and a chapel of some importance; and there are points of great interest in the halls of Agecroft, Denton, Newton, Ince, Wardley, and in many others scattered over the county of Lancashire. Cheshire, although not quite so rich in manor-houses as Lancashire, possesses some of great age and beauty. Of these, Baguley, the residence of Sir William Baguley or Baggiley, in the days of Edward II, which, indeed, has fallen to the position of a farm-house, is a magnificent example even yet of a mediæval dwelling-place of the fourteenth century. Bramhall, of the time of Edward III, with its long record of continuous habitation by the Davenports, is a place to awaken memories, and the quadrangular hall of Adlington, with its additions of various dates, is a place that well deserves study. To these, dotted about the county, may be added Wythenshawe Hall (*temp.* Edward III), and Holford Hall, heretofore the residence of the Holfords and the Cholmondeleys and of the "bold Lady Cheshire," where many a gay assembly took place — a quaint old house with a massive bridge of stone over the moat. There are very many others almost of equal interest, the names of which would be too numerous to record here; and as to the quaint old farmhouses, with a timber gable or two left to them, or perhaps some detached building of mediæval times used as a barn or a dairy, they must be left to the traveller to discover. The singular richness of Lancashire and Cheshire in mediæval manor-houses, or the remains of them, points to the prosperous condition of the counties at the period. Unfortunately, as time goes by, it tells disastrously upon such as are ill preserved, and these are tending fast towards decay; but it is well that there is some permanent record of a number of them in Mr. Henry Taylor's very intelligent work on the "Old Halls of Lancashire and Cheshire," and in several other books on the subject.— *Saturday Review.*

UNHEALTHY CHURCH VAULTS.



ABOUT the end of 1882, complaints were published in the newspapers respecting the escape of foul gas into the parish-church of Ippledon, in Devonshire, from a corpse buried in a wooden coffin under the chancel of that edifice. This occurred notwithstanding the coffin was covered with a coating of cement, and was enclosed in a brick-and-mortar receptacle, and the space between it, and the flags of the chancel — which were laid in best Portland cement — was filled with earth.

That subject I took as a text, upon which I wrote an article, published in the January number of the *Sanitary Record* for 1883, entitled "Gas-tight Graves." Among other questions discussed in such, I pointed out the very poisonous, and occasionally mortal, effects which had resulted from decomposed bodies under sacred edifices, owing to the bricks, cements and mortars used, with the view of preventing the exhalation of gases from these corpses, being all more or less permeable to air, according to tables quoted. I also stated how I thought vaults and walled graves under churches might be hermetically sealed against the emission of effluvia.

Shortly after the nuisance referred to, horrible stenches arose in one of the City of London churches from the corpses interred beneath; and the authorities used a thick coating of concrete in the hope of stopping these odors. Very recently the Church of St. Mary Woolnoth, Lombard Street, has been closed to adopt means to prevent exhalations within it from a vast number of decomposed human remains in the vaults below.

Now as I had reason to believe that the condition of these receptacles were as bad as could be found, I inspected them by the kind permission of the rector of the church. They presented the most unhealthy and repulsive appearance. Several of the coffins were exposed; some of the lids were open, and one, I noticed, contained human remains in a state of decomposition. Most of the coffins in these vaults are of wood. The very small quantity of earth which had been used to cover the coffins had many and great inequalities of surface, as if dogs or jackals had been scratching it. The dimensions of the main vault are about 30′ x 20′. A small vault or recess communicates with it. Both have arched roofs of common bricks and mortar, and are very pervious to foul air. Within the larger vault there are about them small shafts about two feet from the roof, leading into the tower, intended for the escape of corpse gas; but as there appears to be no artificial inlet for the admission of fresh air into the vaults, or any exhaust at the summit of the outlet, it would not get rid of a material amount of the effluvia unless the enclosures suddenly became charged with an extraordinary amount of such by the bursting of a coffin.

The Lombard Street Post-Office adjoins St. Mary Woolnoth Church, and one of the leading employés in that establishment told me that the odor which was perceived there from the corpses in the vaults was at times almost unbearable, notwithstanding the entrance doors to the office are continually opened. He added that he had frequently complained of this nuisance. Only a brick wall appears to divide the vaults from the post-office. It is not surprising, therefore, that it is permeated by poisonous gases from the vaults.

In order to render these enclosures healthy it is intended by the direction of Mr. Penrose, architect and cathedral surveyor of St. Paul's Churchyard, who will have the supervision of the work, to cover the coffins with earth, and to lay on the surface corrugated-iron joists, embedded in and covered with concrete and surmounted with asphalt. By these means, I think the escape of all underground air will be stopped; as it has been experimentally demonstrated that asphalt or a substance containing tar is the only composition which is impervious to gas.

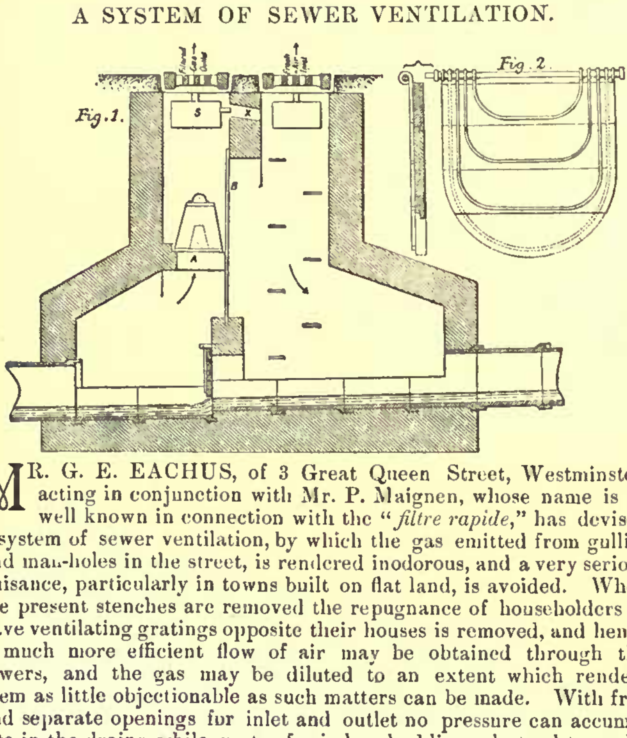
Although statute law exists to prevent church vaults being dangerous to health, no provision is made by any legislative enactment or otherwise for periodical inspection of these receptacles. The facts, however, disclosed by the appearance of the vaults at St. Mary Woolnoth Church, render this step urgently necessary, as it clearly shows that even when bodies have been interred in leaden coffins for more than thirty years they may become highly dangerous to health. Other facts may with great reason be mentioned in support of this much required reform; one is that under several urban churches, corpses have been interred in wooden coffins only, so that the decomposed matter of their contents must have greatly poisoned the earth, and added to the unhealthiness of the vaults wherein they were deposited. Cases are recorded in which persons have died from the effect of grave-earth mixed with decomposed corpses accidentally coming in contact with cuts or bruises on their hands. As wooden coffins are made of different kinds of material, and of various degrees of thickness, and are placed in some vaults wherein they will be preserved for a greater length of time than in others, much

danger is likely to result to public health from wooden coffin vaults, even if they have been closed for forty or fifty years.

Again, it is generally thought that if human remains are interred in leaden coffins, either effluvia will not escape from such, or, if it does, this will only occur after the lapse of twenty, thirty, or more years, consequent upon the deterioration of the receptacles, when it is supposed the gas will have lost by far the greater part of its toxic properties. Now there is a considerable amount of reliable testimony to the contrary, some of which was disclosed in the Parliamentary and other official inquiries more than forty years ago respecting the injury to health in cities and towns by the interment of bodies under and about churches and chapels. It has been proved that leaden coffins have liberated gases from their contents, either from defective soldering, or from being torn by the force of the effluvia. Then as to the poisonous power of this gas after being confined for forty years or more, although no analysis appears to have been made of such, it is doubtless very great: for among other facts and opinions expressed on the subject it is stated before a Parliamentary Committee, by a medical man, who had examined many church vaults, that when the portion of an old graveyard was dug up in the metropolis to make a sewer, one of the workmen accidentally struck his pickaxe into the coffin in which the corpse had been enclosed fifty years previously, and so perceptible was the gas that "it issued from the coffin like the steam from a teapot, and the stench was insufferable."

From the foregoing facts and observations, and the probability that the vaults of many London and other urban churches would be found to be as dangerous to health as those of St. Mary Woolnoth, it is very necessary that steps should be commenced to provide for the periodical inspection advocated without delay.—*J. Neville Porter, in the Sanitary Record.*

A SYSTEM OF SEWER VENTILATION.

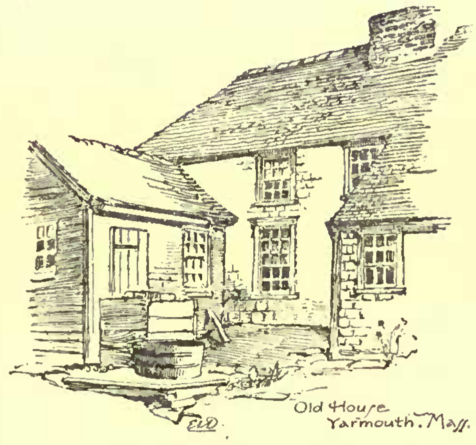


Mr. G. E. Eachus, of 3 Great Queen Street, Westminster, acting in conjunction with Mr. P. Maignen, whose name is so well known in connection with the "*filtre rapide*," has devised a system of sewer ventilation, by which the gas emitted from gullies and man-holes in the street, is rendered inodorous, and a very serious nuisance, particularly in towns built on flat land, is avoided. When the present stenches are removed the repugnance of householders to have ventilating gratings opposite their houses is removed, and hence a much more efficient flow of air may be obtained through the sewers, and the gas may be diluted to an extent which renders them as little objectionable as such matters can be made. With free and separate openings for inlet and outlet no pressure can accumulate in the drains, while gusts of wind and eddies only tend to make the flow of air more rapid. The inventors, therefore, recommend the use of valve closets, without siphon traps, and they thus gain an unobstructed passage for the sewage matter from the house to the outfall, without any cavities in which time is afforded for putrefactive changes to take place.

The sewer is divided into short lengths of about three hundred feet each, each section being separated from the next by a non-return flap-valve (Figs. 1 and 2, above), which opens when the liquid current is in the normal direction, but closes if the flow should be reversed. This valve is very ingeniously arranged. It is made in four or more sections (Fig. 2), each separately hinged to a rail above the water level. These sections open separately; at ordinary times, when there is no storm-water, the upper three remain shut, and prevent all flow of air into the next section, the current being diverted up the man-hole and through the filter. The man-hole is divided into two shafts, one for inlet and one for outlet. In each there is hung a dirt-box; that in the upcast shaft discharges its overflow through a passage in the partition into the downcast shaft, and thus the filter is never wetted. The filter may be of any efficient construction, that shown on the engraving being two perforated truncated cones, with the intermediate space filled with charcoal. It is found that the charcoal remains dry, and performs its office satisfactorily, even if not changed, for twelve months.

The system has been tried for some time in the Town-Hall at Edmonton, where it has worked admirably, and experiments are now being made with it at Newcastle by Mr. G. W. Laws. Mr. Eachus obtained a gold medal at the Inventions Exhibition.—*Engineering.*

THE WORLD'S FUTURE FUEL.



The Scranton Board of Trade recently published a report on the anthracite coal industry which takes a roseate view of the future of the fuel question. Properly assuming that the welfare of the human race depends largely on its skill in obtaining artificial heat and power, the report argues that the deposits of anthracite in Pennsylvania are destined to be the chief source from which mankind, in North America at least, are to be supplied with comfort.

In order, however, not to exhaust the supply prematurely and unnecessarily, improved methods of utilizing this coal must command the attention of the country. To two of these improved methods the report is largely devoted. That the present method of using coal, or indeed any kind of solid fuel, is wasteful in the extreme, has long been maintained by scientific investigators. In the general utilization of coals only from ten to twenty-five per cent of possible heat is made available. If its claim is well founded, the field for invention in the direction of greater economy in the use of fuel is certainly inviting. The two improved methods discussed in the report under consideration consist of burning coal in a pulverized state, and in using it for making fuel gas.

Pulverized coal has been used for some time in a few localities, it is claimed, with entire success. The National Armory in Springfield is one of these places, this method of consumption having been introduced there in 1883. The coal is reduced to a powdered form so fine that it will float in the atmosphere, and it is carried into the burning furnace by a current of air artificially produced. In the powdered form everything is consumed, making no smoke and leaving no ashes. Machinery for pulverizing the coal has been brought to a satisfactory stage of perfection, and it is claimed to be both economical in use and comparatively inexpensive in construction. By pulverizing the waste coal at the mines, culm and screenings can be used up clean. As there are mountains of this waste now on hand, its use for pulverizing will effect an important saving of the original deposit.

The heating powers of pulverized coal are thus stated by Charles E. Emery of New York, as quoted in this report of the Scranton Board of Trade: "The finely-divided combustible, being kindled by the flame drawn from the fire-boxes, burns in the descending current with great energy, and from the comparatively large surface exposed to the action of air, generates a great amount of heat, and, with an excess of fuel, an intense light. The great fiery blast, nearly filling the tower (of a blast furnace) can, at pleasure, be made oxidizing or reducing in its action by regulating the supplies of fuel and air. I have seen it, at twelve feet from the top, so potent as to heat rapidly to whiteness two feet of a wrought-iron bar an inch in diameter, and cause it, though supported at both ends, to bend like wax beneath its own weight in thirty seconds after it was placed in the blast." For blast furnaces, for great forges, for generating steam, and for all purposes of obtaining power and heat for mechanical purposes, pulverized coal is certain to come into use, it is claimed, because of its greater effectiveness and its vastly greater economy.

But pulverized coal, superior in every respect as it is as compared with lump coal, is manifestly a crude, cumbersome fuel compared with water-gas fuel. On this subject the committee who prepared this Scranton Board of Trade report is very enthusiastic. The processes of making the gas, its component parts, and the economies of using it are set forth with a good deal of particularity. Water-gas is, of course, no new product, but the process of making it has been so expensive as to bar it out from the competition for cheap fuel. Late inventions have cheapened its manufacture, so that it can now be put into general use, it is claimed, with assurance to the consumer that his fuel for all purposes of generating power, of warmth in his apartments, and of cooking his food will be cheaper than solid fuel, while he will be rid of the annoyance of handling coal, of carting away ashes, and of having his apartments soiled by dust.

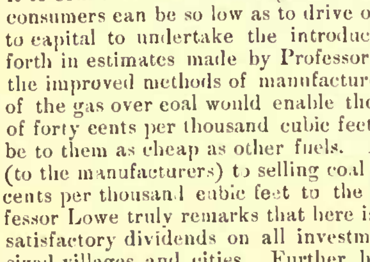
On the authority of Professor T. S. C. Lowe, who has been foremost in bringing the processes of making cheap fuel gas to their present stage, it is claimed that one ton of anthracite coal will suffice to generate from 50,000 to 100,000 cubic feet of gas. The average of 80,000 cubic feet is used in the calculations of the Board of Trade report, but the maximum number, 100,000, can be reached with properly constructed apparatus. The cost of the gas is, on this basis, and after making due allowance for cost of plant, estimated at nine cents a thousand cubic feet. When this gas is brought into general use for fuel, as the Scranton report considers to be certain,

the cost of it to consumers will necessarily vary according to circumstances; but the cost of manufacturing it for a given consumption is not at all problematical, even with appliances so far secured for making it. In the city of Troy, N. Y., a water-fuel-gas plant has been in operation since midsummer. It is the only one, it is believed, in this State. The supply is to the laundries with which the city abounds, to the collar factories for power, and to hotels, restaurants and private houses for heating and cooking. The cost of making the gas at this plant is said by the managers to be about ten cents a thousand cubic feet, and the charge to consumers is fifty cents a thousand cubic feet. It is used in gas-stoves and heaters that are comparatively inexpensive because they are simple contrivances which give no trouble in their management. The gas furnished is non-luminous, the blaze resembling that from alcohol. It is, however, intensely hot. A common nail held in the blaze of a jet with a pair of tongs will be heated to a white heat in a few seconds. The gas has no odor.

The process of manufacturing and using this fuel is claimed to be already so nearly perfect as to secure its rapid introduction to use, while a tempting offer is thrown out to the public in the way of cheapness and convenience. The Committee of the Scranton Board of Trade are refreshingly sanguine on this subject. "The contemplation of the gas subject in the anthracite coal fields," they say, "is almost like an Aladdin story. In scientific nomenclature, it may properly be designated as anthracite gas." They make an estimate that brings the cost of manufacturing this gas down to less than two cents a thousand cubic feet. If the cost of making and distributing it to consumers can be brought to ten cents a thousand, the cost to consumers can be so low as to drive out solid fuel. The inducement to capital to undertake the introduction of this kind of fuel is set forth in estimates made by Professor Lowe, who is the inventor of the improved methods of manufacture. He says: "The advantages of the gas over coal would enable the consumers to pay an average of forty cents per thousand cubic feet for the gas, which would then be to them as cheap as other fuels. At this price it would be equal (to the manufacturers) to selling coal at $32 per ton, and at thirty cents per thousand cubic feet to the consumer, $24 per ton." Professor Lowe truly remarks that here is a margin large enough to pay satisfactory dividends on all investments necessary to supply good-sized villages and cities. Further he says: "One thousand cubic feet of gas per day to each ten inhabitants for manufacturing, domestic heating, cooking and lighting, is a low estimate; nevertheless at this rate a city of 50,000 people would consume 5,000,000 feet daily, which at 40 cents per 1,000 feet would be $2,000 per day gross income, to produce which would require sixty-three tons of coal and the labor of ten men, besides book-keepers, collectors and officers, the expense of which is easily figured."

The vision of the Scranton Committee, as shown by their report, rests finally on a project to make this water-gas fuel in the very mines of the anthracite deposits, piping it thence for consumption; in other words, taking up the hint nature has dropped in the shape of natural gas, these sanguine gentlemen see the possibility of going under ground for the purpose of continuing the supply of gas by artificial means when the natural supply fails, and of competing with the natural supply if it does not fail. — *N. Y. Evening Post.*

SOME INCIDENTS IN THE LIFE OF H. H. RICHARDSON.



NUREMBURG

A WRITER in the Boston *Transcript* gives us this glimpse of Richardson's probation after he finally returned to America:

In the year 1866 I was boarding in Brooklyn, N. Y. One day, on returning from my daily walk, I noticed some large, brass-bound boxes in the hall, marked "Paris," and also "*Etats Unis.*" Aye! I said to myself, we have a new boarder; and those who make a home in a private boarding-house know that there is much curiosity felt at the advent of a new comer. At the six o'clock dinner there appeared at table a gentleman whom I judged to be about twenty-six years of age. Let me describe him exactly as I recall, to-day, his looks at that time. He was of good height, broad-shouldered, full-chested, dark complexion, brown eyes, dark hair parted in the centre, and had the look of a man in perfect health and with much physical vigor. He wore his clothes, which fitted him well, with an indescribable air of ease, differing much from the other gentlemen at table, who, though no dudes, followed the fashion closely and seemed self-conscious of their good appearance. The stranger appeared to me like one who had dressed himself properly in his room and thought no more about it afterwards than he did about the color of his hair or the shape of his head. His cravats had a careless ease about them which the others had failed to win. His shoes were thick, broad-soled, and looked more as if made in England than in France. This gentleman was my next-door neighbor, his room being between the bed-room of my son (a young clerk at Claflin's) and my little parlor. Thus we met often in going to and from the dining-room, and naturally learned something of each other. He said that he had just come over from France, where he had been for some years in the Polytechnique School. Now and then he came into the little parlor and chatted awhile. I could not talk French with him (he preferred that to English, for he had used it so long), but I read the language easily, and he kindly offered his books for my reading. These books explained his profession. They were upon architecture and kindred studies; how valuable I was not aware at the time. From himself I learned that he was a direct descendant of Priestly, and when he found that he had an interested listener he told me about his mother, who was then living in New Orleans. Mr. Richardson stammered in his speech, and as one near to me had the same defect I was never embarrassed by this hesitation, and perhaps he talked more freely on that account. He said that immediately on coming to New York he had entered into partnership with a gentleman whom he met in Paris, and who had offered him a position when he (Mr. Richardson) should arrive in the United States.

We had been boarding a month or two at the same house, when I had an opportunity to buy a pretty little house, and, preferring the quiet of home, decided to go to housekeeping. Mr. Richardson went to see the house, and in the evening he came into my room and said, "Mrs. P., I want you to take me as a boarder."

"Why, Mr. Richardson, I know nothing about keeping boarders."

"No matter if you do not," was his reply. "All I want for breakfast is hash, with the addition of a cup of coffee so strong that you can never wash the cup white after using."

"As to the coffee, Mr. Richardson, you can have that," but to the hash I demurred. "A Parisian, as you seem to be, and want hash every morning!"

Then he gave me a sketch of his housekeeping in Paris. He had a suite of rooms with a fellow-student, and a "*vielle fille*" as servant, who probably with the skill of a French woman made some sort of "*hachis*" or ragout which was very toothsome, but which in the hands of an Irish servant would be as palatable as witches' broth. There was little more said upon the matter, and I went to my old home to forward furniture and bedding. My son went to the house and decided to remain there; but feeling lonely at night, was very glad when Mr. Richardson proposed to join him, taking their meals at a restaurant. They unpacked mattresses, blankets and pillows, and came home tired enough at night to enjoy the freedom of their life. Mr. Richardson, with the ease and rapidity of long practice, rolled up his cigarettes, and then would tell the younger man of his life in France; of the cathedrals of the Old World; of Herculaneum and Pompeii, and the grand palaces of Europe.

I was puzzled on my return to know what to do with my cultured gentleman — for gentleman he was, in every sense of the word. If he had been less so, the difficulty would have been greater.

He occupied a small back parlor, quiet and retired. Here he brought his library, and here he spent many hours of patient study, as we shall see. We had a faithful servant, who would make the coffee exactly as ordered, but other dishes supplied the place of the hash.

After a few weeks he came to me and said, "I have dissolved my partnership. I stand alone in the world, without the means to pay my way."

There was a proud humility in his manner which amused and interested me.

"Do not be troubled," I said. "Something favorable will turn up after awhile. Stay on with us."

I did not know the man well enough to understand his strength, and the veiled genius that walked by his side was hidden from my eyes. I knew he was in perplexity, but I failed at the time to fathom the undercurrent of despondency which troubled his life.

There were two things which buoyed him up in those days of gloom — the attachment to the lady afterward his wife, and the care of himself physically. No matter how cold or freezing the weather, he plunged every morning into a large bath-tub full of cold water; and with his well-fitting, nicely-made brogans, which seemed to do half the walking for him, he took long walks, and felt the better for the exercise.

He one day broached the question whether marriage was or was not an impediment to a man whose ambition led him to aim at a high position in art.

Of course, woman-like, I argued that loneliness and lack of sympathy would only hamper even an artist, who wished to attain to the full measure of a man.

> "A tower of strength
> To stand four-square to all the winds that blow"

Then he told me of his engagement. Of all the men whom I have known, he had at that time the purest and noblest views of true marriage. He wished me to see the lady, and when I went to Boston he gave me an introduction. On my return, I could most sincerely congratulate him on his choice.

One evening he said to me, "I am going to Tiffany to see if I can get work in shaping and ornamenting gas-shades."

There is some difference between designing gas-shades and drawing the plans for Trinity Church, Boston, but a true genius manifests itself in small as well as great things. "The thunder that smites the Alps can gather itself into the width of a golden wire."

Gas-shades at that time were neither artistic nor beautiful. If Richardson had taken them in hand, they would have been unique and attractive. Whether Tiffany had need of such work I never learned — if so, the worse for Tiffany and the better for Richardson.

He was going to the Century Club one evening, and as he passed

out of his room he said, "Look at me, I wear a suit made by Poole, of London, which a nobleman might be pleased to wear, and — and — and I have n't a dollar to my name."

He said this so cheerfully, and with that same proud humility to which I have referred, that even then I did not realize his despondency.

It was a dark hour to him. Such hours come to all men who achieve greatness. They are inseparable from that patient, slow climbing which all men of genius understand. It was the trial hour of the great architect, and he came out of it the stronger for the struggle, like the strong swimmer, who, breasting wind and tide, finds the innate strength of which he had not before been conscious, and reaches port in safety.

Meanwhile Mr. Richardson was busy with his pencil in the little back parlor. Not far from this time came the sad news of his mother's death. At once — he could hardly wait for the next train — he must go for sympathy to the one who held a place in his heart next to his mother. There was a child-like simplicity about this man which he may have hidden as he came more in contact with the world, and his life was filled with work and care, but it was in his nature.

He told us that when he was at school in Paris, he was bountifully supplied with money from home, but during our Civil War, suddenly, to his great annoyance, all remittances stopped.

"How could you live?" I asked.

"Ah!" said he, "I had classmates and other old college friends in Paris, and they were generous and full of sympathy. The names of these friends were often on his lips, for he delighted to recall his college days. I had great reverence for Harvard, because of a long list of ancestral divines, who had graduated there; but my veneration was changed to admiration of the jolly, genial fellows who rallied round Richardson in those dark days. Their names are now before me, and though the class were remarkable for their *cœur d'esprit,* they builded better than they knew when they stood so firmly by their friend.

Say what you will, no man climbs the ladder of fame wholly unassisted. Our Gethsemanes are trodden in unshared agony, but on the upward Alpine path the guides and alpenstock are at our service.

At last Mr. Richardson disappeared for a day or two. On his return he said that he had been introduced by a friend to Mr. Chapin, president of the Boston & Albany Railroad, and through his influence he was to be the architect of a new church in Springfield, Mass. He went to work with great interest, though he had not been idle during his waiting time.

He showed me some of his plans. I had neither the knowledge nor the culture to appreciate them fully, yet I could instinctively feel beauty and know when work was well done, even though I was ignorant of the difference between the Venetian Gothic and the Lombard Gothic and the various orders of the Renaissance. One thing is certain — if "the value of any work of art is exactly in the ratio of the quantity of humanity put into it," then Mr. Richardson's work was good, for he put his soul into it. He believed in "bold, rich, living architecture," and in good work or none. In his estimation poor architecture had no "*raison d'être.*" He used jokingly to tell about a student at the Polytechnique who was kept a whole year drawing chimney flues. Probably, then, they would be more useless to draw smoke upwards than the hole in the roof of a Laplander's hut. He did not like that the architect should be fettered by lack of money in the builder. In his view, the best use of money is to spend it in architecture to which posterity may point with pride.

I am trespassing on the work of the critic. My simple story is to tell how this church broke the monotony of the long waiting and gave him something to do worthy of his hand. A dead wall no longer shut him in, or, to use a homely phrase, he knocked it down with stern patience and a strong will and then revelled in the sunlight. I use the right expression, for he rejoiced in his work, and more and more the master-mind guided the cunning hand to nobler work, for his delight was in the grand laws of architecture, and is not that in a true sense the law of the Eternal?

From this time Mr. Richardson gained steadily in his profession, but not until he removed to Boston was the full measure of the man appreciated.

A hand more able than mine will write his life, and show us how, by the thoroughness of his work, his untiring industry, and more than all, by the originality of his genius, he takes precedence in his profession.

Alas! In the strength of his manhood, when he had girded himself for nobler work than any which he had yet wrought, death called him away, and he passed from us to the "immortals."

COMMUNICATIONS

THE POINT OF GREATEST DEFLECTION.

TRENTON, October 5, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Permit me to call attention to a common error which occurs in the article in "Safe Building" in your issue of October 2. The greatest deflection of a beam loaded with a single load not at centre of the span is there stated to occur at the point where the load is applied.

A simple experiment with a flexible strip will show that this is not true, the greatest deflection occurring at a point between the load and the centre of the span. A simple formula for determining the position of this point correctly and also the amount of the deflection is given in the hand-book published by the New Jersey Steel and Iron Company, edition of 1885, page 34*a*. With the nomenclature used in your article the position of the point of greatest deflection would be $\sqrt{\frac{l^2 - m^2}{3}}$ from the farther bearing. FRED J. SLADE.

NEW YORK, October 16, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — My authority for the statement which Mr. Slade complains of is Weisbach, Volume 1, § 245, and it would seem that we could not have a better authority. He gives an elaborate proof showing that the greatest deflection is where the greatest bending moment is, *at the load.* But, alas! for the fallacy of the most exact demonstration of "The Father of Mechanical Science." Mr. Slade's simple experiment, made with an ordinary tee-square completely disproves it. Since seeing Mr. Slade's letter I have consulted some thirty authorities and was amazed to find how many either ignored the point, or else worked up to it and then dodged the issue. I find, however, that Mr. Slade's formula simplifies very ingeniously one that is adopted by Weyrauch, Klasen, Dubois, and the German Ingenieur Verein, and as its result agrees quite closely with a very elaborate formula given by Thomas Box (strength of materials, p. 364, ed. 1883). I shall be glad to make the correction before the book-plates are cast, and wish to thank Mr. Slade for so promptly calling my attention to the matter. Yours very truly,

LOUIS DE COPPET BERG.

NOTES AND CLIPPINGS

THE CRERAE QUARRY ACCIDENT.—On September 25 a lamentable accident, of an almost unprecedented description, occurred at the Crerae quarries, on Loch Fyne, near Inverary. The corporation of Glasgow obtain stone from the quarries, and once a year it is customary for a party of officials, their friends, and others, to visit the place, and witness a blast on a large scale. On this day 50,000 tons of rock were to be displaced. There was the additional interest of the occasion being a jubilee celebration of the Statute Labor Committee. The steamer with the party arrived off the quarries shortly after one o'clock, and was brought up a little within a mile from the shore. As on former occasions, the signal for the explosion to take place was given by the steamer sounding her steam-whistle. The charge was immediately fired, and in less than a minute the whole face of the quarry heaved outwards, between 60,000 and 70,000 tons of rock being dislodged, and the operation proving very successful, as far as the purpose for which it was intended is concerned. The smoke having somewhat cleared away, the steamer was taken a little nearer the shore, and those of the passengers who desired to do so were allowed to land in boats for the purpose of examining the result of the blast. About three hundred persons, many of them ladies, availed themselves of the opportunity, and were landed on the beach. The steamer then continued her run to Inverary, the arrangement being that she should pick up those who had gone ashore on the return journey. When the company assembled on the beach they immediately proceeded to the quarry, accompanied by Messrs. Alexander and John Faill, the lessees, Mr. Sharp, the manager, and Mr. William Sim, the proprietor, these gentlemen explaining to various groups of ladies and gentlemen the nature and extent of the operations carried on at Crerae, and the blasting processes by which the rock was obtained. In this way the visitors entered the quarry — which, it should be explained, takes in the interior the shape of a horseshoe — and there was nothing, so far, to indicate that they were incurring the smallest possible risk. Before many minutes had elapsed, however, many members of the party, at all points, seemed suddenly, and in the midst of animated conversation, to be overpowered by some invisible vapor, and fell motionless to the ground among the stones. The officials, at once realizing that the catastrophe was due to choke-damp, called out to the people to run, but in the consternation with which every one was more or less seized the warning was either not understood by many, or they found themselves powerless to act upon it. For some minutes persons continued to fall, most of them without even uttering a word or cry, and to lie upon the ground to all appearances dead. In this way it is said that in the course of a few minutes no fewer than from eighty to one hundred persons were prostrated. Eight men were killed and a large number injured.

The history of the Crerae Quarry at Furnace, and of the blasting operations there, is closely connected with the efforts made by the Glasgow Police and Statue Labor Committee during the last half century to improve the causewaying and paving of the city streets. When the management of the streets was transferred, in 1836, from the old Statue Labor Trust to the Board of Police, the thoroughfares of the city were in a miserable state of repair, and all laid with "common rubble causeway." The contractor for the cleansing and lighting of the city was Mr. William Sim, who at once entered with energy into plans for realizing the desire of the committee to improve the system of street paving. The success of these plans is described in a memorandum prepared by Mr. Sim for the occasion of the large blast of

September 25, which was fired in honor of the Statute Labor Committee's jubilee, accompanying which memorandum is a statement by Messrs. William Sim & Co., the lessees of the quarries, containing particulars of the blast and elevations of the quarry face. The first paving experiments were made with blocks of square-dressed whinstone, for obtaining which quarries were opened at Kilsyth; but the results, as indicated in the paving of Jamaica Street, were disappointing, the blocks being found pitted and full of holes after being down only three years. The late Mr. David Lyon was acting manager for Mr. Gibb, contractor for the building of Glasgow Bridge, and he afterwards contracted for the building of a quay at Inverary, and was permitted to quarry a portion of the materials from the rocks at Furnace, some ten miles to the south, and on the western shore of Loch Fyne. Soon after the Committee took over the streets management several hundreds of tons of dressed granite causeway stones from Furnace were used in paving a portion of Jamaica Street, and in 1840 this was found to be in excellent condition, the stones being in such good preservation as still to show the marks of the tools used in preparing them. The result was to convince the committee of the necessity of substituting granite for whinstone in street-paving; and in 1841 permission was obtained from the father of the present Duke of Argyll to open a quarry at Furnace, and a contract entered into to supply a thousand tons for the paving of High Street. From that date the operations for the quarrying of the gray granite of Furnace have gone on in an extending scale, so that the great bulk of the stones employed in paving the existing city streets has come from this source. In 1852 the first "great blast" took place, and was attended with such satisfactory results that the system has since been regularly continued, ten "blasts" having been fired up to the year 1855 The great blast fired on September 25 was, as has been stated, designed to be a celebration of the completion of the fifty years' labors of the Statute Labor Committee, and elaborate arrangements had been made in connection with it for the success of the operation, and for the safety of life and property. It was to be fired, as the official statement says, "immediately on the arrival of the *Lord of the Isles* at a safe distance within view of the quarry face. The gunpowder in the chambers will as usual be exploded simultaneously by means of electricity from a battery technically called an exploder. The captain of the *Lord of the Isles* will sound a steam whistle as a signal to the operators, and in less than a minute, if all goes well, the blast will be over." As the plans show, the "bull's eye," or mouth of the entrance mine, was situated 30 feet above the floor of the quarry, and from it to the top of the perpendicular face was other 60 feet of rock. Upwards from this, however, the rock had a receding rise to a considerable height, so that, in vertical line from the mines and chambers to the flagstaff overhead there was in all 100 feet of superimposed rock. The entrance mine extended backwards for 60 feet, and then divided, sending off at an obtuse angle, for other 20 feet, galleries to the right and left, each ending in a powder-chamber. Between each chamber and the face of the quarry there was a depth of 70 feet of rock, and in each was contained 7,000 pounds of powder—in all, 14,000 pounds, equal, according to the standard by which gunpowder is sold, to 7 tons. The working dimensions of the blast, from the western to the eastern dividing joint, was in width 100 feet, and taking the height as we have described it at 100 feet, and the thickness at 70 feet, there were 25,925 cubic yards of rock to be displaced, requiring. at 2 tons per yard, an expenditure of force equal to 51,850 tons. The expectation, however, of the contractors, fully borne out by the results, was that if the blast worked successfully a large number of tons additional would be removed by natural falls of the rock occasioned by the disturbing action of the explosion. As has been said, the blast was believed to be a great success by those who had charge of it. The great mass of rocks was torn to fragments by the explosion, and the belief was entertained that a greater fall than they had anticipated had been realized. Of course, the distressing nature of the subsequent proceedings naturally prevented the inspection necessary to verify the opinions formed. It may be mentioned that the blasting was carried out under the direction of Mr. Adam Sharp, the manager, and Mr. John Jardine, the engineer of the quarry.—*The Architect.*

Lime-Blasting in Coal-Mines.—An official report by English commissioners on the new method of blasting without powder, by means of lime cartridges, expresses the opinion, as the result of close observation as well as of frequent inquiries and experiments, that, for coal-getting, the new lime process can be, to a large extent, substituted for that of powder, and that its employment secures comparative immunity from danger, and is unattended by any important practical difficulties. The plan has been subjected to trial in many of the most important mining-districts, and proved itself capable of competing, and even advantageously in point of economy, with powder—in many descriptions of coal—the working being such as to allow of several charges being applied at one time. It is not claimed that this lime cartridge system affords the means of dispensing with the use of explosives or of specially powerful mechanical appliances in the removal of stone, or even in some hard coal, or in connection with certain methods of working underground.—*Exchange.*

Novel Bells.—There is always a risk of failure in casting large bells; uncertainty whether the bell will be sound when cast, and liability to eventual fracture. The transportation of such heavy weights as bells of large dimensions to their destination, and the hanging of them when there, are always matters for serious consideration. It will be remembered what preparations were made and precautions taken for the transport of the great bell of St. Paul's, and the difficulty of its hoisting and hanging; and now, being hung, it would be dangerous to swing its enormous weight—some eighteen tons. It is of interest to note, therefore, that in England a bell has been invented which is claimed to obviate all these difficulties. This bell, as we find it described, is not cast, but made of metal, bent or spun to shape. A bell may be made in several pieces, and hand-soldered together. The peculiarity of the result is that the bells give an astonishing volume of sound. A bell weighing but three and one-half pounds gives quite as much sound as a cast bell of ten times the weight, and the tone is very pure and true. The vibrations last twenty-five seconds, and the overtones or harmonics are quite perceptible. The inventor guarantees to produce a bell weighing one ton which shall be as musical and as efficient as an ordinary bell of twenty tons. Various attempts have been made to use sheet metals for bells, but they have all failed hitherto; and the reason why the inventor has attained an unprecedented success seems to be that he has hit on a peculiar alloy, which appears to possess some remarkable properties. It is well known that ordinary bell metal is hard and brittle. In the present case, however, a method has been discovered by which a bell metal is produced which will be resonant in a very high degree, but admits of being bent. It bears, that is to say, about the same relation to ordinary bell metal that malleable cast-iron bears to ordinary cast-iron. Although the inventor, a Mr. Hoffman, of London, is confident that he can produce very large bells in this way, he has not made any, and it remains to be seen how far he will be successful; but he has done enough already to excite the interest and claim the attention of every campanologist.—*The Iron Age.*

TRADE SURVEYS

The possibility of such a boom in railway construction as will crowd prices to a permanently higher level is now attracting attention of those who operate with large blocks of capital. One railroad extension of six hundred miles has just been determined upon in the Northwest. Three other extensive railway enterprises are to be pushed to completion south of the Ohio. A dozen or more trunk-line extensions between New York and Chicago have just been resolved upon. These are simply samples of the improving activity. Unusually large orders have been quite recently given out for freight cars. Many lines report a scarcity of cars; in fact, shippers at all large commercial centres complain, more or less, of delay from this cause. Keen competition is springing up on the various Pacific lines. New coastwise ship lines will probably be established next year. Money is once more returning freely from the interior, thus laying the foundation for larger operations now projected in many quarters. Inside of the industries themselves there is great activity. Orders crowd in for winter delivery. Consumers are apprehensive of higher prices. An enormous amount of business has been done for winter and spring delivery at full prices. But for this a general advance would have been made ere this. Manufacturers have been, and still are anxious to fill their order-books. The building trades are less active than a month ago as to new business, but busier than ever on summer contracts. Skilled labor is advertised for in all our larger cities. Winter work will be abundant where it is possible to prosecute it. The characteristic of this winter's building operations will be the erection of large edifices, banks, warehouses, railroad work, tunnel work, etc. The possibility of spring labor agitation will be a factor which will affect the quantity of winter work done. Greater activity is assured in building and loan association circles next season. Real estate authorities have recently stated that lot-buying for small houses has been indulged in to a greater extent this year than ever. Large tracts have been laid out and sold in many cities and towns East and West, especially in Pennsylvania, New York and Ohio. This is the result largely of high wages and steady employment in the industries. Building material is very firm, but has not advanced. The New England lumber-trade maintains its activity. Wholesalers have been unable to accumulate supplies, and in primary markets, both West and South, mills are well supplied with orders. Contractors at home have placed large orders for sash-doors and interior lumber. It would take very little more to push prices up, but there are so many markets from which lumber can come that anything like an organized control is out of the question, therefore no advance will be made until there is no possible escape from it. New York and Philadelphia lumber markets are fairly supplied and no more. Our advices from several cities show that real estate is active, and that the bulk of sales are for those who intend to build. The Chicago brick-yards, except two, have shut down. The crop for the season is put at 370,000,000 against 335,000,000 last year. Last year the winter stocks were 60,000,000. This season they are practically *nil.* The winter's season will be a prosperous one. Great building activity is reported along all the lines leading out of that city. Recent advices from St. Louis show that much work is in the hands of architects. In Louisville and Cincinnati summer work is drawing to an end, and considerable winter work is contemplated, especially among the smaller manufacturing industries. The interior cities are holding up their credit, and dullness is not mentioned. The iron and steel makers are delighted at the almost unexpected rush of orders. The output has reached the highest limit. Pig-iron has advanced throughout the country from 50 cents to $1 per ton, as compared with summer prices. The advance has checked some expected business. Number 1 Foundry is $20 at tide-water; $18 for number 2, and $17 for gray forge—all best grades—with 50 cents to $1 less for lower grades. Mill owners are booking orders for winter. Rail-mill owners report increasing orders. Urgent buyers have placed orders in foreign mills for early winter deliveries. Large car orders have been given out. Ship-builders have an abundance of business in sight. The carriage and wagon makers have shops on ten hours on winter business as good as assured. The machine shops, and builders of all kinds of textile and shop machinery express no concern over the permanency of the present activity. Several New England machinery builders are working overtime. The only wanting factor is a large export trade in food supplies. In the long run, it is perhaps better that we should be saved from a fluctuating foreign trade. The food markets are not so liberally stocked as to stand an export drain for a long time without a speculative advance. Such an advance would create unrest among the workers and open the way for agitation for higher wages and shorter hours. The labor outlook is favorable to the permanency of friendly relations. Employers will not be taken by surprise next year, as they were last. Workmen themselves will be more conservative under organization. The leaders will throw their interests on the side of gentle measures. Yet contingencies are likely to arise which may precipitate widespread agitations, and produce harmful results. The building interests will be careful to ascertain the purpose of organized labor before the actual opening of next year's business.


HOTEL
THE RED LION. WYCOMBE, ENG.
Ye LION: of S.t MARK. VENICE:
Lions' Heads. Assyrian Sculpture.
The LION of BELFORT' FRANCE COLOSSAL STATUE BY A BARTHOLDI
Head of Lion. Mediæval Sculpture.
THE LION OF BRUNSWICK GERMANY
A Waterhouse A.R.A. Arch t
From Nat. Hist. Museum London - Eng.
Heraldic Lion in Panel. Mont. S. Michel. France.
IN DOGES' PALACE. VENICE.
PANTHER Between Dormers. Nat. His'y. Museum. London. Eng. A. Waterhouse. A.R.A. Arch't.

LIONS.

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THE telegraph brings intelligence of the death of George Godwin, the well-known architect, and until within a few years the editor of the English *Builder*. Mr. Godwin was born near London, in 1815. He received his professional training in the office of his father, who was an architect of reputation, and practised with success in London. Early in his professional life he had found amusement in writing, not only on technical but on lighter topics, and in 1844 he became the editor of the *Builder*, which he managed with extraordinary success for forty years, resigning it at last when advancing age made it necessary for him to give up a portion of his work, into the able hands of Mr. Statham, the present editor. Under him the *Builder* was perhaps the most popular and most frequently quoted technical journal in Europe, and the opinion of its editor was anxiously sought on nearly every professional subject. The universal respect and regard which Mr. Godwin enjoyed among architects was shared by a large portion of the public, his zeal for his art, and his activity in promoting its interests, bringing him into relations with a great many persons of all classes. The movement for the establishment of the famous Art Union of London was greatly aided by his efforts, although, at the time of the incorporation of the association, he was but an enthusiastic young man of twenty-four. Later in life he became deeply interested in the improvement of the habitations of the poor. Every reader of the *Builder* will remember the importance which was given to the subject in its pages, and its editor became one of the best living authorities on lower-class dwellings. If we are not mistaken, Mr. Godwin, in giving up the control of the *Builder*, intended to devote a part of the time which he thus gained to a more thorough study of this important matter, and his death, at a time when his knowledge and experience might have been most useful, will be felt as a serious loss among those who endeavor to ameliorate the condition of their fellow-men by work, and not by oratory.

THE *Société Centrale des Architectes de Belgique* appointed, not long ago, a commission to study the question of architectural competitions, and see if something could not be done to make them more attractive to the best men in the profession. The subject is not, it must be confessed, a particularly new one in meetings of architects, but the Belgian committee succeeded in handling it in a style altogether novel, and has made some suggestions which are well worth considering. Finding, or more probably knowing beforehand, that most architects believe the judgments on competitions to be given so much at random that there is little credit in engaging in them, even for those who win the prizes, the committee says that it has concluded that a system of points would best meet this objection to the present methods of judging. Supposing, for example, that to the expressions "very bad," "bad," "passable," "quite good," "good," and "very good," are allotted values of one, two, three, four, five and six, respectively, zero standing for the absence of a drawing; and supposing, again, that the relative importance of the six drawings, and the written description required in a given competition, is rated by allowing twelve points to each of the two floor-plans, eighteen points to the elevation of the principal front, twelve points to the side elevation, twelve to the section, twelve to the detail sheet, and six to the written description, with these data an excellent and perfectly fair comparison of the different sets of designs can be made by judges of comparatively little skill as experts.

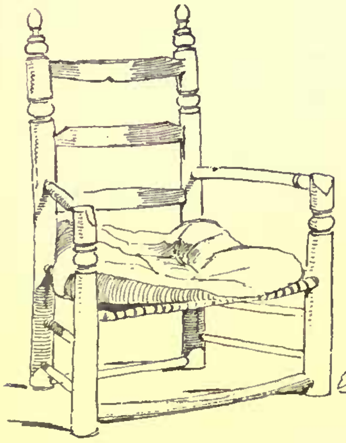
TO illustrate this by an example, we will imagine that four designs have been submitted in competition by Messrs. A, B, C and D. The first member of the jury finds A's entrance floor plan very good, which counts him twelve for that item. The second-story plan, on the contrary, is only passable, and as this adjective is worth only half as much as the expression "very good," and as twelve is the maximum mark for a floor plan, A gets for his only a mark of six. The front elevation is "quite good," and, by the same process of arithmetic gains for its author a mark of eight. The side elevation is "good," and is therefore worth ten; the section is "very good," and gets twelve; the detail sheet gets eight in the same way, and the description five. Each member of the jury marks independently of the rest, and at the end of their examination their marks on each design are added together and divided by the number of members, and the quotient recorded as the official mark of that design. When all are judged, the premiums are allotted in the order of the marks, and here a further improvement upon the ordinary plan is suggested. Instead of announcing arbitrary premiums, it is proposed that the whole sum appropriated for premiums should be divided between the first two or three competitors in proportion to their marks. Thus, suppose A in our imaginary competition to have gained sixty-eight marks in all, after averaging the points assigned him by the different members of the jury, while B has in the same way obtained seventy-four points, C, fifty-one points, and D, fifty-five. There are to be only three prizes, so that A, B and D will alone be entitled to share in them, and the total prize money, which we will suppose to amount to sixteen hundred dollars, is to be divided in the proportion of the marks of each candidate. B, therefore, who had a mark of seventy-four, will get six hundred dollars, in round numbers, A, five hundred and fifty dollars, and D, four hundred and fifty; while C, who has obtained more than half the possible highest mark, is comforted with an honorable mention. By this means the reward of each of the ablest competitors will be somewhat proportionate to his merits, and a man who may be only a hair's-breadth inferior to another will have this fact certified by receiving a compensation nearly equal to that of the other, instead of being sent off with a ridiculously small portion of the premium allotted to one whom the turn of a hair, almost, might have caused to change places with him. Novel as this plan for conducting competitions seems, we quite agree with *La Semaine des Constructeurs*, from which we borrow the description of it, that if the associations of architects wished they could easily obtain the general adoption, either of it or of a similar one. Unlike most of the schemes of competition presented by architects, this commends itself as much to the laity as to the members of the profession. Most men desire to be fair in judgment, and know well enough that the last plan presented in competition is apt to upset all their previous ideas, and carry off the prize; and a system of marks, by which they could judge deliberately, and to a certain extent intelligently, and would be in no danger of being continually distracted by the new beauties unfolded by each successive design that they came to, would be regarded as an excellent thing. The averaging of the marks of the jury would obviously tend also to correct individual prejudice, and the distribution of the premiums in proportion to the final marks could not be objectionable to the lay promoters of competitions, while it would tend greatly to attract good architects, and this is what all decent promoters of competitions want.

FOR some months a portion of the Grand Opera in Paris has been lighted by incandescent electric lamps, put in by the Edison Company in January last, on a six months' trial. The trial having proved satisfactory, the lamps, with the machinery and apparatus for producing the light, have now been accepted by the management of the Opera, and gas will probably never be used there again after this year. Even the huge "lustre," the heavy but gorgeous chandelier which hangs in the centre of the auditorium, is fitted with electric lamps in place of gas jets, much to the advantage of the portion of the audience which occupies the upper tier of seats. *Le Génie Civil* gives a description of the apparatus used for furnishing the light, from which it appears that the motive power consists of a Corliss engine, of three hundred horse-power, with a fly-wheel sixteen feet in diameter, making sixty-five revolutions per minute, multiplied at the shaft to two hundred revolutions per minute. This is supplemented by an Armington & Sims high-speed engine, of one hundred horse-power, making three hundred revolutions per minute without a fly-wheel, which is to be used only when the larger engine is out of service. These engines drive three dynamo machines, and two others are kept ready in case of emergency. Lamps of two kinds are used, most of them being of the sixteen-candle sort, but ten-candle lamps are used in the great chandelier, and a few, of thirty-two candles, are placed on the grand staircase. Altogether, seventeen hundred incandescent lamps are in regular use in the public portions of the theatre, and the *loggia*, or open balcony in front of the great foyer, is provided with eight arc-lights. The seventeen hundred incandescent lamps of the auditorium replace twenty-two hundred gas-jets, burning about twelve thousand cubic feet of gas per hour, and discharging perhaps a hundred thousand cubic feet of products of combustion into the air during the same period, and as the ventilation of the Opera at ordinary times is none of the best, according to our notions, it may be imagined that the frequenters of the theatre applaud the change. As we observed the lighting, a few months ago, it appeared to be managed with remarkable skill. The turning-down of the light, which is difficult with any electric lamps, but is indispensable in the case of theatres, was very successfully done, and it is probably for this reason that the directors of the Opera, in concluding their contract with the Edison Company, have resolved to substitute electricity for gas on the stage, as well as in the auditorium. The stage, with the dressing-rooms and work-rooms, all of which are now included in the contract, will need many more lamps than the auditorium, and the final installation will comprise six thousand one hundred and seventy-six incandescent lamps, all of which will be of ten-candle power except the eleven hundred sixteen-candle lamps, and the twelve of thirty-two candles, which are already in service in the auditorium and vestibule. These lights will replace seven thousand five hundred and seventy gas-jets, which includes the whole number in the building. With the consent of the police authorities, even the safety lamps in the corridors and about the theatre, which are, in all modern theatres, provided with an independent supply of gas, or even of oil, so that they will not be extinguished in case accident or panic should lead to the turning off of the main lights, are, in the Opera, to be replaced by incandescent lamps, fed from four great storage batteries, so placed that any two might be destroyed without extinguishing the light.

SOME years ago the Bell Telephone Company made a few experiments, in the course of which the operators had occasion to observe the effect upon the telephone signals of the currents passing through neighboring telegraph wires. It was found that if a telephone wire ran along one side of a street, and an ordinary telegraph wire on the other side, the Morse signals on the telegraph wire could be distinctly read in the telephone instruments. This was at the time thought quite surprising, and when the Bell experimenters subsequently asserted that on one of their wires, which ran through a quiet country district, they could hear the peculiar signalling of the American Rapid Telegraph Company's system, although the nearest of the American Rapid wires was five miles away from their line, they were hardly believed. Now, however, it is proved by experiments made expressly for determining this point, that signal currents are communicated from wire to wire at far greater distances than this. At the time of the Bell Company's trials, the American Rapid Telegraph was operated by means of a very powerful battery, and the currents transmitted through the wires were many times more intense than those of the ordinary systems, and would naturally be perceptible at a greater distance; but Mr. Preece and his friends in England have found that even with the ordinary Morse instruments, and the batteries commonly used with them, signals on one wire could be distinctly heard on another forty miles away, the two wires having no medium of communication more direct than that furnished by the earth or the air between them. To make sure that no mistake had been made in the experiments, a special commutator was placed on one of the wires, which, instead of sending the ordinary Morse signals, transmitted regular impulses, so rapidly as to produce a musical sound. By varying the rapidity the pitch of the sound was made to rise and fall, and this unmistakable sound, on putting the apparatus in action, was distinctly heard in the telephones connected with the other wire. To determine whether the communication took place through the earth or the air, Mr. Preece and his companions made two distinct and complete circuits of insulated copper wire, laid on the ground. The circuits were about a quarter of a mile in diameter, and nowhere approached each other within a quarter of a mile; yet conversation was so readily carried on between telephones connected with the independent circuits that it appeared to the experimenters probable that the distance might be much increased without making the signals so faint that they could not be understood. As another illustration of the possibilities of transmission of electric currents, without metallic conductors, it is said that not long ago, when the telegraph cable from England to the Scilly Islands was broken, signals made at the shore end of this cable were read on the receiving instruments of another cable, crossing the Channel to Brest, and lying nowhere within half a mile of the Scilly Island line.

THE *British Architect* of October 15 contains an admirable obituary notice of Mr. E. W. Godwin, one of the best architects in England, who died on the sixth of the month, at the age of fifty-eight. Mr. E. W. Godwin, who must not be confounded with Mr. George Godwin, lately the editor of the *Builder*, who, as we mention elsewhere, died about two weeks later, will long be remembered, in connection with Waterhouse, Burges, Street and Scott, as one of the ablest leaders of the modern school of English architecture. In his tastes, and treatment of the problems presented to him, he resembled Burges more, perhaps, than any of the others, but although perhaps less original than that extraordinary genius, he surpassed him, to our mind, in dignified and well-studied composition. In fact, the most striking characteristic of his work was the perfection with which it was studied, and the beauty which, by that means, he was able to obtain simply by the distribution and proportioning of openings, and the position of string-courses; and in this art, which of all others, perhaps, requires the highest mental power, he had, as we think, no rival in England. Such work as he wished to do, however, requires much time as well as thought, and of late years he had found it advisable to turn his attention to a lighter class of design. At first, like his friend Burges and several other architects of talent, he devoted himself to furniture, and most of our readers know the quaint and pretty devices which he produced so easily. Later, however, he became interested in the decoration of theatres, and theatrical scenery and costuming, and soon found constant employment in this sort of design, which he succeeded in nearly revolutionizing. At first he contented himself with arranging costumes for certain plays which interested him, and as this led him to study the archæology of his subject, the scenery and stage-setting came to be included in his ideas, and were placed under his control, until he became one of the most important factors in the production of several plays which won very great success; the best known, perhaps, being the famous "Claudian." In the midst of this work, the hurry and excitement of which perhaps overtasked his nervous strength, his vital powers failed, and he died in the prime of his intellectual capacity, leaving a name which, by the few who knew him intimately, will be cherished as that of one of the most thorough artists of his time. Among students of architecture, to whom he was always kind, and for whom he wrote most instructively, he will be remembered in a different, though not less pleasant way, and we hope that for their benefit some of his admirable criticisms and suggestions, together with as many as possible of his beautiful designs, may be collected and placed within their reach.

ORIGIN OF MALARIAL EPIDEMICS.[1]



Old Chair in the Pilgrim Hotel. Provincetown. Mass.

The modern theories of the etiology of diseases, and especially the germ theory, must compel us to recast our views of the origin of malarial fever.

Whoever pretends that malaria arises *de novo* from the conjunction of heat, moisture and vegetable decay, although supported by the evidence of competent observers in many countries, and by the great weight of authority of the best medical and sanitary writers, who recognize these three as essential factors, must encounter many strange and inexplicable contradictions, and find himself compelled to show, not that under certain conditions of soil-moisture and temperature malaria had undoubtedly arisen, but to explain why, under precisely similar conditions in countless instances for a long series of years, it may be a century, this disease has been unknown in localities where it has suddenly appeared as an epidemic.

On the other hand, he who denies, *in toto*, that these three factors have any agency whatsoever in the etiology of ague, is forced to admit that his chief arguments are based upon exceptions and negations, and that a single positive fact may scatter them to the winds.

It is believed by the writer that the epidemic at Framingham offers an unexampled opportunity for the study of the natural history of malaria.

The connection of intermittents with the erection of dams, especially upon winding streams, having broad margins of meadow and wooded swamps, where the flow is impeded and the water becomes stagnant and the land "drowned" — this connection is well known; while instances are numerous enough not to require citation, where, not only in other countries and along our western rivers, but here in New England the disappearance of malaria has been with undoubted justice attributed, not to time alone, but to the removal of dams and obstructions, and the draining and cultivation of wet lands.

It is unnecessary to quote the opinions of writers, sanitary and medical, upon this point. We must admit the value of such testimony. But in order to narrow the question somewhat, and to give this paper a local character, a table is annexed showing the views entertained by the various observers of previous epidemics in Massachusetts, taken from the admirable essays on this subject of Drs. Holmes and Adams, to which reference has been already made.

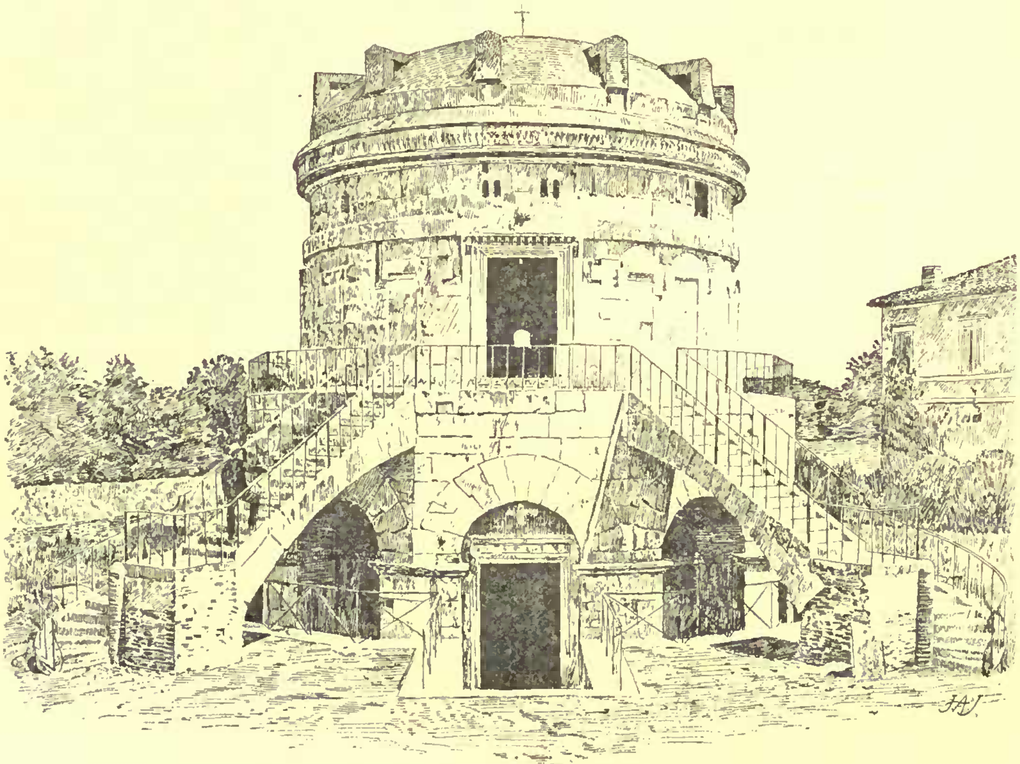
We will now pass to a consideration of the conditions in Framingham.

At the close of the year 1874, the city of Boston decided to take the Sudbury River as an additional water-supply, and for this purpose began the work of excavating for three large dams upon that river and one of its principal tributaries, called Stony Brook. Soon after, work was begun upon a conduit from Farm Pond to Chestnut Hill Reservoir. In constructing the dams, the river was diverted and its old bed laid open to the sun and air. Great quantities of alluvial mud were exposed and dug up in every direction. The excavations for the foundations of the dams were deep and extensive, long wings being required by the porous nature of the soil. This work was chiefly done in the summer. The foundations were in some cases twenty or thirty feet in depth. The men who performed this work lived in miserable barracks or shanties, temporarily put up as near to the places of labor as possible. They drank the water of the more or less stagnant river, and passed their days and nights in the midst of its mud and fogs.

The Chestnut Hill Conduit was constructed directly through and upon the meadows supposed to be the seat or nidus of the malarial infection of the epidemic of 1885. Here again very extensive upheavals and removals of muck and marsh deposit were made, it being necessary to find below the ooze a solid basis upon which to build.[2] The peat and mud were removed from the whole width of the cutting and replaced by gravel, or when no firm bottom could be reached, as happened in parts of Guinea Meadow (the swamps in question), piles were driven and planking laid. A more extensive and thorough turning up of wet and decaying vegetable matter (more or less mixed also with the sewage of the neighboring village, which gravitates to this meadow), it would be difficult to conceive of.

Several hundred men were employed upon this construction, there was quite a numerous population in the territory north of the line, and scattered houses in every direction. Much of the work was done in the summer, the time of draught and small rainfall, when the water was lowest in the meadows. These are drained by Beaver Dam Brook, a sluggish, obstructed stream, having a slow water-shed of three thousand acres.

Here then were present in the highest perfection in the precise locality of the epidemic of 1885 in South Framingham, the conditions assigned as the probable cause of malaria in certain reported cases in Massachusetts, besides numberless instances in this and other countries where epidemics have been attributed, by competent observers, to digging and removing the soil in the construction of streets, sewers, etc., etc.



The Tomb of Theodoric, Ravenna, Italy.

All the work above described was completed at least *seven years before* the epidemic appearance of intermittent fever in Framingham.

The summers of 1870 – 1871 were periods of drought and low wells, and also those of the years 1877–78–79–80, and especially 1883, when the total fall of water in June, July, August and September was only about half that of 1882 and 1885. This condition has been cited by some observers as having a connection with malaria.

Much of the picturesque beauty of Framingham, for which it is so justly celebrated, is due to the many pieces of water which meet the eye at every turn. Besides the larger lakes and the river Sudbury, which winds through the middle of the town from the southwest corner to the northeast, there are numerous smaller ponds, streams and brooks; some of the latter being winding and stagnant, others rapid and quick. These, in spring freshets are apt to rise and overflow their banks and cover the meadows in all directions. Several times within the memory of the writer, such a freshet has occurred upon Stony Brook and the Sudbury River and their tributaries, tearing away culverts and roads, choking up the natural drainage of meadows with vast quantities of gravel and silt, and leaving behind pools of stagnant water, which, having no outlet and escaping chiefly by evaporation, remained green, slimy, and festering far into the summer. In the end of March, 1876 (the year of the commencement of the work of construction of dams by the City of Boston), such an overflow took place. This condition has been assigned frequently as one of the contributory causes of the epidemics of malaria.

In 1872 Lake Cochituate became very low, and in order to draw water into it from Farm Pond and the Sudbury River, a connection

[1] Portion of the report by Dr. Z. B. Adams on "Malaria in Eastern Massachusetts" in the Supplement to the Seventh Annual Report of the State Board of Health, Lunacy and Charity of Massachusetts.

[2] In one case the mud was removed to a depth of twenty feet.

was made by means of an artificial ditch or canal discharging into Beaver Dam Brook, which was, however, abandoned the next year. It was again opened in 1875 and used until 1878, when the connection with Farm Pond was completely severed, and, the brook being obstructed, this canal became stagnant and has since remained so. It receives the drainage of perhaps forty houses, and its wooden sides have fallen in. It is especially in the vicinity of this stagnant ditch that malaria has been rife during the epidemic. It is proper to remark that this condition of things has been in existence since 1879. Of variations purely atmospheric there is little to say. The mean summer temperature of 67°–68° remained unchanged in 1885. In the months of August [1] and September the days are apt to be very hot and the nights cool, damp and foggy, especially in low grounds and near streams or meadows. The Guinea Meadows contained rather more stagnant water than is usual throughout the summer, in 1885, but the difference was not material. The rainfall during the last days of July and in August of that year (the time of especial prevalence of malaria), was unusually great — 7.34 inches in thirty days. If this had any effect whatever, such a rainfall must have acted, we should suppose, to abate the epidemic influence. The interesting fact is noted, however, that on the days immediately succeeding a heavy rain an increase in the number of fever cases was observed, suggesting a direct connection of cause and effect.

But it is preëminently in and around the reservoirs and dams of the Boston Water Works that those precise conditions prevailed which are assumed to have direct association with the origin of malarial epidemics. Saturation of soil and vegetable decay, foul exhalations and effluvium arising from organic matter decomposing in connection with heat and moisture, the effect of the sun upon "drowned lands," associated usually with the presence of dams and artificial reservoirs of water, these are suggested or referred to in some way or at some time, in explanation of the appearance of intermittents in twenty-five of the thirty towns enumerated in the accompanying table.

In Framingham, as has been already said, about 850 acres are occupied by these reservoirs. The town covers say 14,000 acres, of which more than half, being on a much higher level, we may assume to be beyond the reach of any malarial influence arising from this source. About one-eighth, then, of the area of the town liable to be affected, whether by soil-water or by exhalations from these basins, is covered by the flowing of the reservoirs when the dams are closed. The Sudbury River watershed is much of it low and covered with wood and bog, and, when raised, the water covered lands which had been farmed and manured for a century. The water had always a yellow color and a pondy taste in consequence.

In 1878–79 the wood was cut and the brush removed, leaving, however, large areas of swamp, covered with stumps and muck, to await the slow processes of chemical change. The dams were completed and the basins allowed to fill. In 1881, during the late summer, the season having been a very dry one, Basin Number 3, containing by far the largest area of flowage, fell so as to expose one-half or two-thirds of its surface, which was largely composed of swamp, covered with rotting stumps of trees, black mud and decaying vegetation. The peculiar effluvium of "drowned land" was almost insupportable in its vicinity. This had been submerged more or less constantly for more than two years. A rank vegetation of fungi and sphagnum appeared. Marsh gas could be seen bubbling up in the stagnant pools. The same condition of things again occurred in 1883, after two years' submergence. In this latter case everything was exposed except the bed of the original stream.

In Basin Number 2, in 1883 and 1884, after four or five years' submergence, the water was drawn down in the same thorough manner, and much work was done in clearing out the mud from the bottom, filling up "dead ends," etc. Large quantities of muck were removed and placed upon the shores.

Basin Number 1, of very shallow flowage, was often very low and smelled badly, but was never drawn so completely down as the others. The water in the gate-houses gave out a strong sulphuretted-hydrogen smell at all times.

Farm Pond was drawn down seven feet in 1881, and a temporary ditch or channel was made around its edge, connecting the conduits independently. At that time its water had the "cucumber" taste already spoken of, and was offensive to the smell. "Professor Ira Remsen, of Baltimore, attributed the objectionable taste to the presence of a species of fresh-water sponge, which was found in small quantities on the gravelly or stony parts of the bottom of the pond." "After a short time the bad taste in the water of the pond disappeared." [2] In 1884, Farm Pond was drawn down two feet, and in 1885 four feet, in order to construct the new conduit marked upon the map, and the southwest portion, being nearly cut off from the rest of the pond, became covered with a rank growth of grass and weeds. There was, however, no complaint of any foul odor from this pond during 1885.

In Basin Number 3, in 1879 (the year of first flowage), the water was contaminated by a growth of minute algæ, similar to that found in the Mystic River supply. The temperature of the air was high at the time of its appearance, and that of the water especially so, occasionally being even warmer than the air, and this at a depth of twenty feet, which, of course, suggested chemical action as its cause.

Speaking of these algæ, Mr. Fteley says: "these minute plants, which appear to be uniformly distributed throughout the water, flow with it, and are of such small bulk that they cannot be separated by screens; the wind has a noticeable effect on them, and often blows them towards the lee shore, where they accumulate and form a solid scum of a sharp green color. When in the fresh state, they emit a very peculiar musty odor; if stranded by the action of the wind they soon decay and form a bluish-green mass, which develops a smell as of organic matter in the process of decomposition. Of the formation of the algæ, or of their origin, little is known; but it is remarkable that they appear very suddenly, and in large quantities; shallow flowage, it is said, favors their development, probably on account of the higher temperature which the water attains in such conditions when heated by the sun; but they are formed very rapidly, also, in deep water. I have observed several times that large quantities appeared in a very short time equally distributed through hundreds of millions of gallons of water, twenty feet deep, several hundred feet from any shore, and in very calm weather. . . . The formation of the algæ appears to follow the temperature of the water, increasing and diminishing with it."

These algæ appeared in Basin Number 1 in 1880, but have since nearly or entirely disappeared.

It is only necessary to add to the above description, that the peculiar sickening effluvium arising from the decay of these minute organisms was distinctly perceptible in the air at a considerable distance from the reservoirs.

It seems unnecessary to follow this vein of investigation any further. It suffices to say, that for nine years the three factors of heat, moisture, and vegetable decay, which, it is assumed, can *de novo* produce malaria, have been present in the greatest activity in Framingham, while none, or rare and doubtful cases of intermittent fever have arisen; whereas, in the summer of 1885, during an epidemic of the disease, few, if any, cases appeared in the vicinity of the great reservoirs and dams, where the three factors had been present in the highest degree.

But, on the other hand, to deny *in toto* the agency of heat, moisture and organic decay in the development of malaria is to utterly reject the evidence of experience and observation. The germ theory enables us to reconcile these conflicting opinions.

All organic life requires these three elements for its growth and propagation, and the higher the development of the organism, the more of these it requires. Hence we may conclude that the malarial germ is a living thing and somewhat highly organized. It cannot be simply chemical, nor magnetic, or telluric. That it differs essentially from the so-called zymotic ferments may be assumed from the fact that in the human organism a first attack does not procure immunity from a second, and that certain races of men, as well as certain individuals, show little susceptibility to its influence. Its natural history, too, seems to be more open to study and observation than that of most of the germs of infectious diseases.

It would appear that the malarial germ requires stagnant water for its growth and development. It will not live in running streams, nor in large moving bodies of water. If you drain the water from the swamps where it exists, and cultivate, that is aerate, the soil, you destroy the germ. You do not draw it into a new location, you kill it outright. Whether this results from mechanical or from chemical causes we will not stop to inquire.

The germ has a certain weight and size; it obeys the laws of gravitation, is blown about by winds, and is stopped by obstacles. It requires a certain temperature, and is benumbed, possibly killed by cold. It is true these statements admit of question, but they are not mere assumptions. They are gathered from the study and observation of a host of facts, collected by competent scientists.

As to the question of the spontaneous disappearance of malaria, this, like its epidemic appearance, we cannot explain; but the same is true of all the germs of epidemic and zymotic diseases, which present this characteristic. A detailed account has been given above of the sudden appearance and disappearance of the anabœna, a species of algæ, in the water of the reservoirs. Here is an organism of easy identification, found swarming in the water, and then going out of existence, unaccounted for, without known origin or cause, its only condition of existence being a rather high water temperature. A similar, but not identical, growth has been discovered in another artificial reservoir many miles away, and having no known connection with the Sudbury basins. Many grosser pests, familiar to agriculture, have this character of periodicity of appearance and disappearance, among which may be cited the seven-year locusts, the canker-worm, the blight, the rose-bug, and many others.

By what avenues is the malarial germ introduced? Two methods suggest themselves; namely, rain-storms and underground-water. Malaria is supposed to rise and be carried to and fro in fogs and mist. This may account for its introduction through the medium of clouds and rain. Thus may occur those occasional appearances of malaria upon high ground far removed from any swamps or meadows.

But the underground movement of water is a factor which has not, perhaps, been sufficiently considered in this question. How often can we know the source of water in deep wells? Many wells are known to remain full in long droughts, or to fill suddenly without the actual presence of rain-storms. There are springs in this country, called "barometric," that, running dry, burst forth and flow in full volume many hours before any rain is seen to fall in their immediate vicinity. Whence comes the head of water, unless it be

[1] August, 1885, was exceptionally cold.
[2] "Additional Supply from Sudbury River," by A. Fteley, Resident Engineer, Boston Water Works, Boston, 1882.

a fall of rain which has saturated the earth and reached the underflow at some considerable distance away?

What do we know of the extent of the substratum of quicksand of varying depth and full of water, found everywhere, it is believed, in Framingham, and extending indefinitely beneath the soil in the adjacent towns? That this is something more than an underground lake of vast extent is very probable. It is believed by many that this water has a certain gradual and imperceptible flow. Whence and whither, we cannot say.

Professor Cantani[1] believes that the malarial parasite enters into the blood more frequently by way of the stomach than by the respiratory tract; that drinking water is the vehicle of the infection more surely than any other means. It is uncertain if it ever enters by the air alone. He suggests, also, that vegetables or fruits which ripen upon the ground may introduce it into the human stomach in some cases.

There are occasionally cases of ague whose etiology is so obscure that none of the explanations here offered can make it clear. They may serve as examples of exception to the rule.

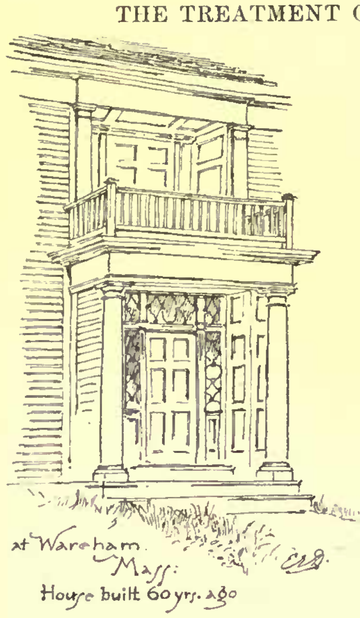
In the epidemic in Framingham there was no case which furnished an atom of evidence to show that the disease was communicated by direct infection or contagion from one individual to another.

The truth, long suspected, now so generally accepted, that malaria, like other infectious diseases, never arises spontaneously, but that the introduction of a germ is necessary, is affirmed. That this germ is a living organism, capable of development under certain conditions of heat and moisture, and of propagation within the body, where it produces the phenomena of chill and fever, then dies and is eliminated, is probable. The theory seems well founded that in the healthy individual this may be the end; while, in many cases, some of the germs remaining uneliminated, propagate again within the body, and thus, after a certain number of hours, produce a recurrence of the ague fit.

The opinion is held that germs once introduced may remain dormant within the human body awaiting favorable conditions for development or propagation.[2]

During the winter of 1885–6 some of the chronic manifestations of malaria appeared, a few being in individuals not known to have had chills and fever, and in March, 1886, the disease began to show itself among those attacked during the preceding summer, and also a few new cases were seen.

THE TREATMENT OF SEWAGE.—I.



THE following is the full text of Dr. C. Meymott Tidy's paper, an abstract of which was delivered before the Society of Arts, on April 14, last, and is too valuable not to receive the widest dissemination possible. As this paper is published in the *Journal of the Society of Arts*, a publication which is maintained more for the recording of useful information than for profit, we do not have those qualms of conscience that even American editors experience when committing pillage on the labors of others.

LIQUID EXCRETA.

Every adult male person voids on an average 60 ozs. (= three pints) of urine daily. The 60 ozs. contains an average of 2.53 oz. of dry solid matter, consisting of—

Urea	512.4	grains.
Extractives (pigment, mucus, uric acid)	169.5	"
Salts (chiefly chlorides of sodium and potassium)	425.0	"
	1106.9	"
	= 2.53 ozs.	

The urine, therefore, of a population of 10,000 adults may be taken as 600,000 fluid ozs., or 3,750 gallons per day.

Urine rapidly decomposes, the urea becoming the volatile body carbonate of ammonia, and the urine thereby losing a valuable manurial constituent. After a time, but at a later stage, certain foul smelling gaseous products of decomposition are evolved. To collect and preserve urine, therefore, presents practical difficulties. The ammonia from stale urine was formerly distilled and converted into a sulphate, at Courbeville, near Paris.

[1] Medical Clinic.—Ospitale Gesu e Maria, monthly supplement of the Gazette degli Ospitali, Naples, June, 1885.

[2] In this manner it is possible to explain the case cited by Dr. Holmes from Rev. Cotton Mather's "Magnalia," of the Rev. John Sherman, who having contracted "an Intermitting but malignant *Fever*," at Sudbury, entered on his *Eternal Sabbath* August 8, 1685. It seems, however, that Mr. Sherman had formerly been settled in New Haven, and there is nothing to prevent the supposition that he may have afterwards visited that malarial region, and there contracted the disease of which he died.—*Dr. Holmes's Essay*, p. 22.

SOLID EXCRETA.

Every adult male person voids about 1,750 grains (or 4 ozs.) of fæces daily, of which 75 per cent is moisture. The dry fæcal matter passed daily is therefore about 1 oz. per adult head of the population. Of this *dry* fæcal matter, about 88 per cent is organic matter (of which 6 parts are nitrogen) and 12 per cent inorganic, of which 4 parts are phosphoric acid. Of this dry fæcal matter 11 per cent is soluble in water.

Taking a population of 10,000 adults, it follows that the moist fæcal matter passed daily is equal to 2,500 lbs. (= 1 ton, 2 cwt., 8 lbs.) or 1.116 ton, whilst the dry fæcal matter is equal to 625 lbs. (5 cwt., 2 qrs., 9 lbs.)

The facts, therefore, respecting the excreta of a population of 10,000 adults may be thus tabulated:

TABLE I.

FÆCAL MATTER PASSED PER 10,000 OF ADULT POPULATION PER DIEM.

		lbs.
Moist fæcal matter excreted		2,500
Dry " " " (calculating 75 per cent as moisture)		625
Soluble in water = 68.55 lbs.; Insoluble in water = 556.45 lbs.	= 625	

TABLE II.

URINE AND FÆCES PASSED PER DAY BY 10,000 ADULTS.

	Total solids.	Water.	Solids dry.	Solids soluble.	Solids insoluble.
	Moist lbs.	Gallons.	lbs.	lbs.	lbs.
Fæces	2500	187.5	625.0	68.55	556.45
Urine	—	3750.0	1581.21	1581.21	—
		3937.5	2208.21	1649.76	556.45

My own experiments would lead me to give one pint as an average quantity of urine passed by children daily up to the age of ten years, the quantity gradually increasing up to three pints in the adult. The solid constituents of the urine which, at the age of ten, are on an average 0.8 oz. daily, increase, according to my observation, up to 2.5 ozs. in the adults. The quantity passed by girls and women is rather less than that passed by boys and men.

This Table has been adapted from Letheby. The quantities given are somewhat below the normal. The facts were collected from a number of sources, the ratio of children to adults being that adopted by Röderer and Eichorn.

CONSTITUENTS.	Weight in ounces avoirdupois of chief constituents of urine and fæces passed by children and adults in 24 hours. Males. Boys.	Males. Men.	Females. Girls.	Females. Women.	Average at all ages.	Weight in lbs. of urine and fæces contributed by a mixed population of 10,000 persons (1,640 boys, 3,020 men, 1,662 girls, 3,674 women) in 24 hours. Males. Boys.	Males. Men.	Females. Girls.	Females. Women.	Total at all ages.
	oz.	oz.	oz.	oz.	oz.	lbs.	lbs.	lbs.	lbs.	lbs.
URINE.										
Fresh urine	19.875	48.490	16.881	42.157	31.851	2073.2	9152.5	1753.6	9680.3	22659.6
Dry constituents	0.969	2.197	0.750	1.588	1.376	99.6	414.7	77.9	364.6	956.8
(a.) *Organic matter*	0.677	1.720	0.574	1.216	1.172	69.5	324.6	59.6	279.2	732.9
Containing nitrogen	0.166	0.481	0.161	0.326	0.284	71.1	90.8	16.7	74.9	199.5
(b.) *Mineral Matter*	0.292	0.477	0.176	0.372	0.332	30.0	90.0	18.3	85.3	223.9
Containing phosphoric acid	0.035	0.069	0.024	0.049	0.044	3.6	13.0	2.5	10.6	29.7
" potash	0.040	0.078	0.027	0.055	0.050	4.1	14.7	2.8	12.7	34.3
FÆCES.										
Fresh fæces	3.421	5.240	1.061	1.414	2.784	351.5	989.9	110.2	324.7	1775.5
Dry constituents	0.879	1.112	0.282	0.376	0.662	90.3	209.9	29.3	86.3	415.8
(a.) *Organic Matter*	0.762	0.930	0.244	0.325	0.567	78.3	177.2	25.3	74.6	355.4
Containing nitrogen	0.049	0.062	0.016	0.022	0.037	5.0	11.7	1.6	5.0	23.2
(b.) *Mineral matter*	0.117	0.173	0.038	0.051	0.095	12.0	32.6	3.9	11.7	60.2
Containing phosphoric acid	0.039	0.062	0.013	0.018	0.033	4.0	11.7	1.3	4.1	21.1
" potash	0.014	0.029	0.004	0.006	0.012	1.4	4.3	0.4	1.4	7.5

The fæces passed by girls and women are considerably less than that passed by boys and men. The calculations in the Table state the amount as less than one-third. My own observations, however, scarcely support these numbers. It would, I think, be more accurate to regard the fæcal matters passed by female children and adults as about one-half that passed by male children and adults.

VALUE OF NIGHT SOIL (HUMAN EXCRETA).

Urine, in its natural condition, has a theoretical value of between

15*s.* and 16*s.* per ton. The dry solid matters of the urine have a theoretical value of about £18 16*s.* per ton.

The quantity of ammonia per year voided by the average individual in the urine has been stated as from 10 lbs. to 11.32 lbs., having a value on the lower quantity of 6*s.* 8*d.*, and on the higher of 7*s.* 3*d.*

Fæcal matter, in its moist and natural condition, has a theoretical value of £1 7*s.* 6*d.* per ton. The dry solid matters of fæces have a theoretical value of £5 17*s.* 7*d.* per ton.

The quantity of ammonia voided per year in the fæces, by an average individual, is estimated at 1.64 lbs., having a value of about 1*s.* 3*d.*

The estimates given above are based on the agricultural values of the nitrogen calculated as ammonia, together with the phosphoric acid and potassium salts, these being materials of sparing occurrence in land, but entering largely into the composition of every variety of agricultural produce. Lime, magnesia and iron, equally essential to plant development, occur largely in most soils. The details are stated in the Table on p. 1129: —

Respecting the value of the nitrogen, however, of sewage, Voelcker regards it as at least of 10 per cent less value than the nitrogen of ammoniacal salts ready formed.

Authorities differ between 6*s.* 6*d.* and £1 in estimating the annual value of the excreta of one adult. Thudichum gives it at £1; Hofmann and Witt at 11*s.* 9½*d.*; Voelcker at 9*s.*; Lawes and Way at 8*s.* 5¾*d.*; Anderson, of Glasgow, at 8*s.*

In the Table we have estimated the mixed excreta of the population as worth 15*s.* 8*d.* per ton in their natural condition, and the solid matter of such mixed excreta as worth £14 15*s.* 4*d.* per ton.

In this Table, moreover, no corrections are made in stating the value of the solid constituents, either for the loss of ammonia that would occur during evaporation, or for the soluble phosphoric acid of the fresh excreta becoming insoluble by its combination with lime after drying. No doubt the loss from these causes is considerable, and tend to show that, when used as a manurial agent, sewage should be applied to the land in its fresh state.

COMPOSITION AND ESTIMATED VALUE OF THE SOLIDS OF URINE AND FÆCES, AND OF THE MIXED EXCRETA OF A POPULATION.

Constituents per ton.	Ammonia (= 7d per lb).	Phosphoric acid. Soluble (= 4d. per lb).	Phosphoric acid. Insoluble[1] (= 2d. per lb).	Potash[1] (= 3d. per lb).	Estimated value per ton.
A. NATURAL STATE.	lbs.	lbs.	lbs.	lbs.	£ s. d.
a. Urine	23.94	2.94	—	3.39	0 15 10
b. Fæces	35.45	—	26.62	9.46	1 7 6
c. Mixed excreta of population	23.13	2.70	1.93	3.83	0 15 8
B. SOLID MATTERS OF.					
a. Urine	567.14	69.53	—	80.32	18 14 1
b. Fæces	151.77	—	113.67	40.40	5 18 7
c. Mixed excreta of population	441.31	48.47	34.43	68.21	14 16 4
d. Sewage of mixed population	172.10	22.89	10.19	48.20	6 3 2
Rotten farm-yard dung	16.0	3.92	5.77	10.00	0 14 1
Fresh farm-yard dung	15.0	3.0	3.92	12.50	0 13 6
Peruvian guano	381.8	67.0	201.00	13.50	14 1 4
1,000 tons of average London sewage.	219.37	27.61	24.20	50.65	0 0 1¾

These estimations of value are theoretical only. Cesspool matter in Paris fetches from 1 franc to 1 franc 25 cents per cube meter (about 1 ton), whilst in Holland and Belgium the average is one shilling per head per annum for the excreta. It would scarcely be an exaggeration to place the real value of the excreta at about one-sixth their calculated value.

Certain comparisons in respect of fertilizing power (and, therefore, of agricultural value), are worth noting —

1 lb. of human excrement	= 13 lbs. of horse dung.
" " "	= 6 lbs. of cow dung (Macaire and Marcet).
Excreta, of one adult (solid and liquid	= Droppings from one sheep (Mechi).
Yearly excreta (solid and liquid) of one adult	= 75 lbs. of Peruvian Guano (Voelcker). (This will yield 3.2 bushels of grain.)
Yearly excreta (solid and liquid) of one adult	= Yield of sufficient nitrogen (16.41 lbs.) to furnish the nitrogen of 800 lbs. of wheat, rye, or oats; or 900 lbs. of barley, value £5. (Boussingault,)

MIDDENS.

Sewage absorbents. — The cesspool and the midden were the first attempts at collecting excreta, not so much, however, for the purpose of profit as with the idea of preventing nuisance. The cesspool had many and great disadvantages, not the least of which were the noxious inhalations evolved, the necessity of occasional emptying, and pollution of the drinking water of the wells in the neighborhood. The ash-pit midden had, and has, its advantages and its difficulties. Of the difficulties, the education of the people to use them properly was chief, a difficulty, however, that applies almost as much to water-closets as to middens. A second difficulty in the use of the middens consisted in securing proper scavengering arrangements by the local authority, a difficulty, it may be again noted, not one iota less great in securing the efficient treatment of sewage. Provided the midden be regularly attended to and properly constructed, *e. g.*, erected away from the house — the pit small — roofed in so as effectually to stop out rain or other water — floored with sloping flags to render the removal of the contents easy — impervious to surface water and not drained, dryness of contents being effected by the use of ashes well distributed over the soil — there are more objectionable ways of dealing with refuse than by the midden system. Under conditions of individual and general supervision, the compost, if sufficiently often removed, need not be a nuisance. But if the midden be neglected by the public authority and by the householder, no doubt it may become a prolific source of disease, as Manchester and Liverpool can testify.

The advantages of the pail system are not to be overlooked. Thus the pails are always placed outside the house; whilst a certain regular process of inspection is rendered necessary, ensuring the detection of a nuisance before it becomes a source of danger. In time of epidemics, again, disinfectants may be extensively used in the pails as they are being distributed.

Another great advantage of the midden system is to be found in the diversion of excremental matters from rivers and water-courses. Much sewage at Manchester is thus kept out of the River Medlock. Strange to say, however, the Rivers Pollution Commissioners (Dr. Frankland) state that the sewage from water-closet towns is no worse than that from midden towns. The following is an abstract of the results recorded by Dr. Frankland: —

AVERAGE RESULTS.

	Matters in Solution.			Matters in Suspension.	
	Total Solids.	Chlorine.	Total Nitrogen.	Total.	Organic.
Midden town sewage (37 samples from 15 towns)	57.68	8.08	4.52	27.38	14.91
Water-closet town sewage (50 samples from 17 towns	50.54	7.46	5.41	31.29	14.36

On this one question suggests itself — how is it that the suspended matter in the sewage of midden towns is almost identical with that from water-closet towns, seeing that Dr. Frankland states that an average of 25,561 tons of solid matter per annum is annually kept out of the sewers at the several midden towns mentioned? (See Report on Pail System at Nottingham by Dr. Seaton, Society of Arts Conference, 1875, p. 155.)

The pail system may consist either in the use of a little disinfectant or of some absorbent material.

Adopting Mr. Gilbert R. Redgrave's classification of the pan, pail, and midden systems of disposing of sewage (Society of Arts Conference, 1877, p. 33), we shall discuss the subject under the following three heads: — I. Pails without absorbents. II. Pails with absorbents. III. Pails used for the joint collection of ashes and excreta.

I. — PAILS WITHOUT ABSORBENTS.

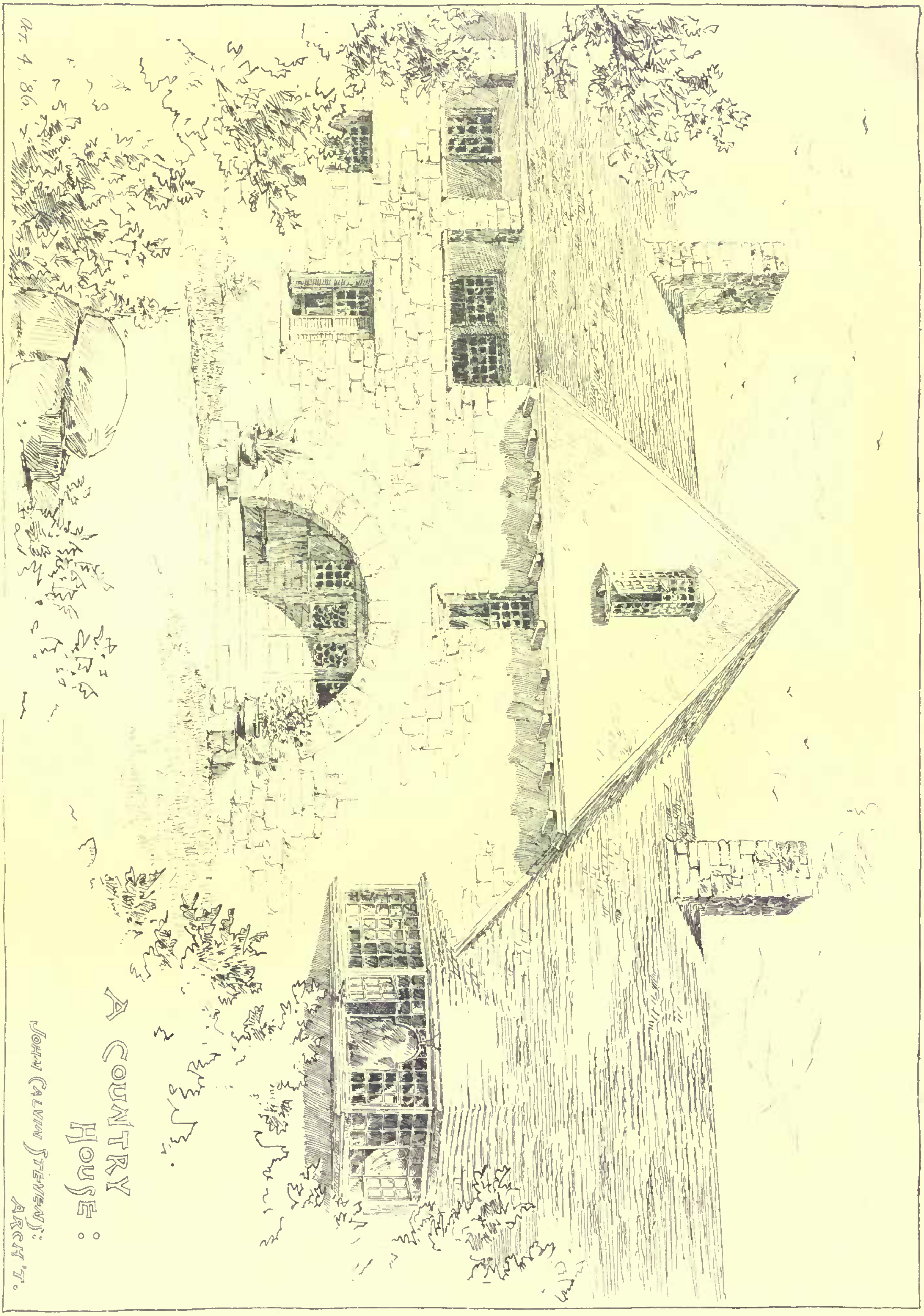
Of these the Rochdale system (see Society of Arts Conference, 1877, pp. 9 and 33, Mr. Alderman Taylor and others) may be regarded as principal. In support of the non-use of any absorbent, it is urged that to keep out "the profligate associate" is a main object; concentration, not increase of bulk, being the point to be aimed at. The excreta and dry house refuse should be collected at intervals in separate tubs of special construction, the excreta tub being fitted with an air-tight lid, so that transport may be effected without causing a nuisance. The cost per pail per annum is about 5*s.* 8*d.* The ashes are carefully screened and sorted.

From the experience of many towns (Rochdale, Salford, etc.), it would appear that two men and one horse (say at a working cost of £3 per week) can remove 600 tubs or pails per week, each pail containing an average of 84 lbs. of excremental matter. This equals 22½ tons per week at a working cost of 2*s.* 9*d.* per ton. At Rochdale, 10,112 pails were in use in 1882, the weight of excreta collected being 8,518 tons, and of refuse ashes 18,396 tons, from 15,289 houses, and 237 mills and workshops, with an estimated population of 65,500. In 1881, 552 tons of manure was manufactured. It is calculated that a tub is used by 9.2 persons living in 2.2 houses, the yield being 2.07 cwts. of excreta per head per annum. At Halifax it was calculated that each tub is used by 10.9 persons living in 2.6 houses, the yield being 3.26 cwt. of excreta per head per annum. At Birmingham the returns give from 9.6 to 11.5 lbs. per week per head.

II. — PAILS WITH ABSORBENTS.

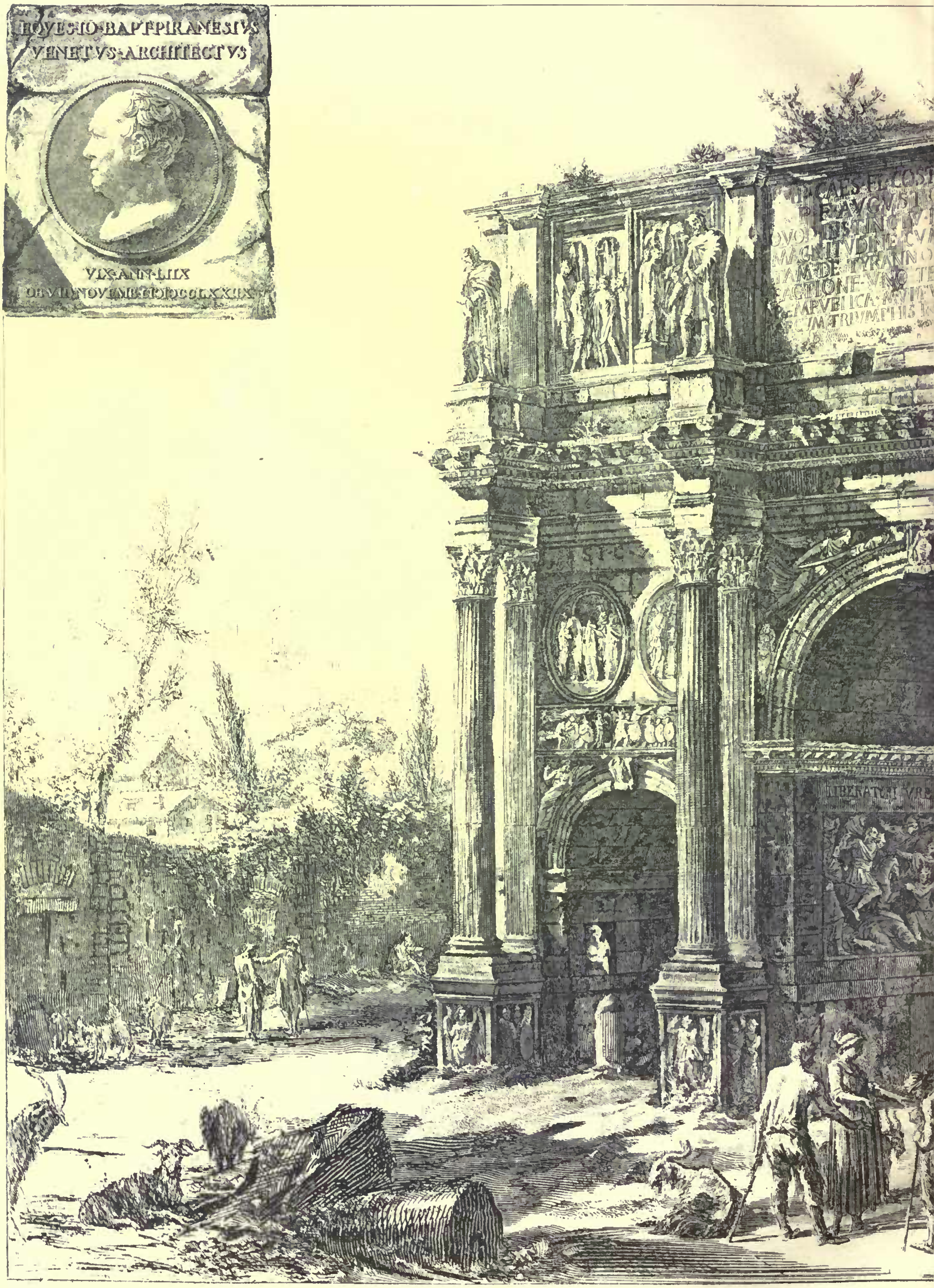
In many places, the use of boxes, pails or tubs, charged with various absorbent materials (ashes, etc.), has been adopted. Numerous substances (see paper in Society of Arts Conference, 1877, p. 49) have been suggested as absorbents. Of these Liebig recommended coarsely-powdered bog turf and Stanford charred seaweed. Stanford claims that seaweed is three times, weight for weight, as effective as dry earth (1 cwt. being sufficient for one month for a closet daily used by six persons. He claims, moreover, that it is easily reburnt, and that the ammonia and fixed salts have been recovered, the charcoal remains as effective as before. Various forms of refuse, too, have been suggested as absorbents, of which may be noted, refuse wool or shoddy, dry horse-dung, spent dye-stuffs, etc. At certain towns, spent dye-wood (such as fustic), in the manner suggested by Goux, viz., ramming into a tub by a central core, so as to give a uniform lining to the tub, has been employed. Thus splashing is prevented. This method necessitates the frequent removal of the excreta (otherwise the absorbent lining would break down and a semi-liquid mass result), and it is also necessary that the receptacle should

[1] 2*d.* per pound would perhaps be nearly the value of potash, and 1*d.* the value of phosphate of lime.

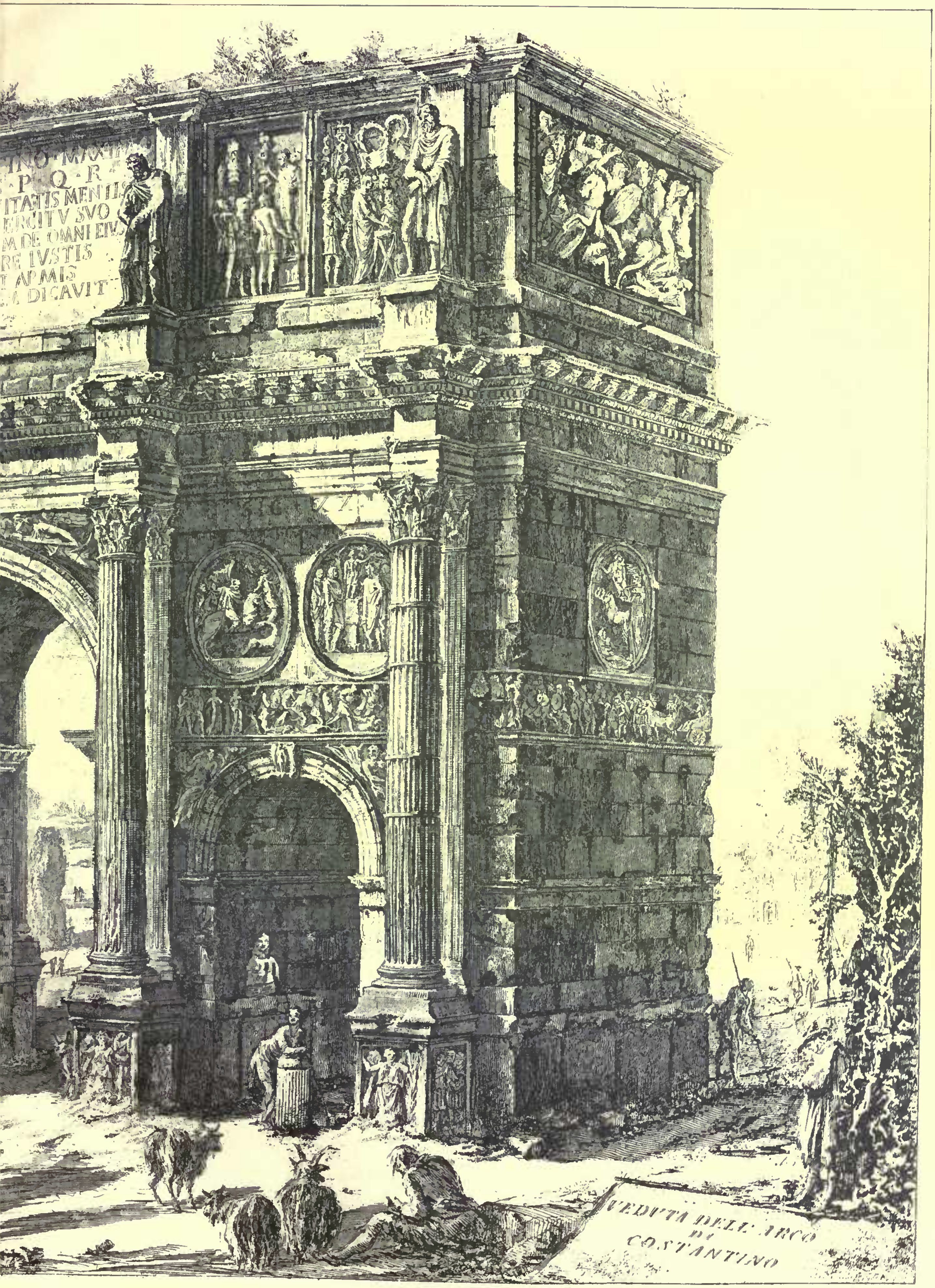


Heliotype Printing Co Boston.

AMERICAN ARCHITECT AN

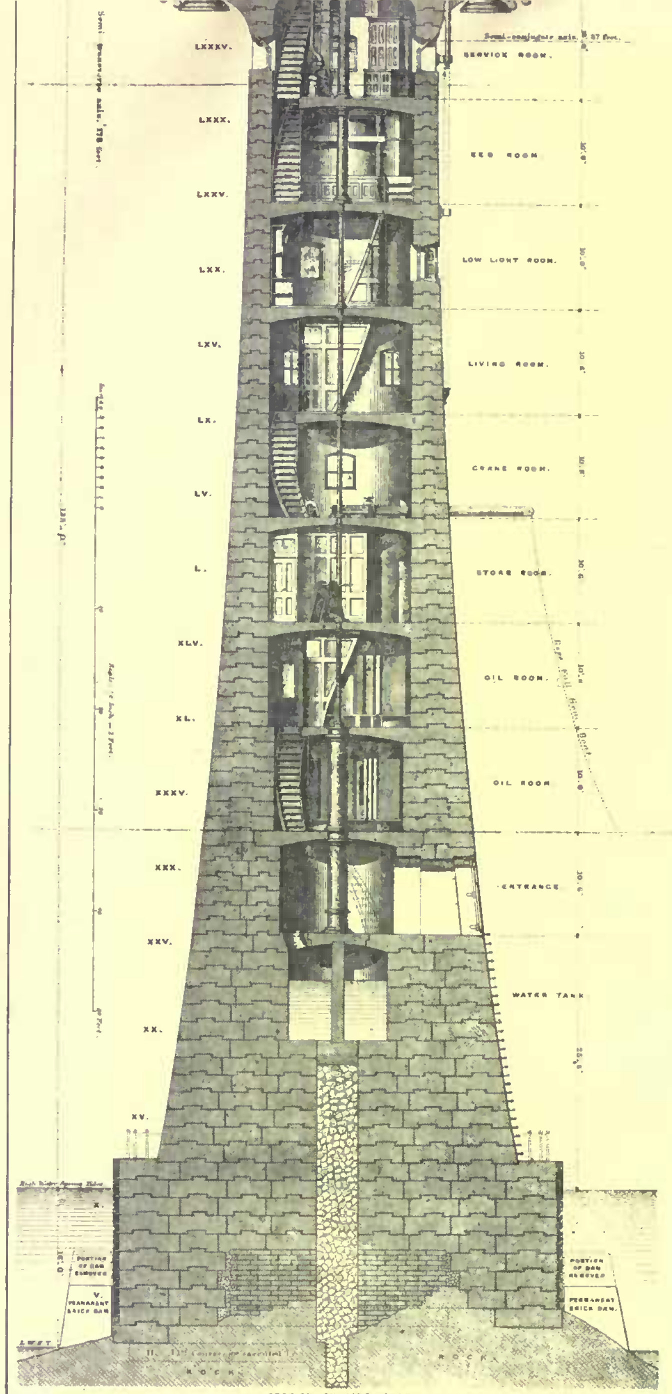


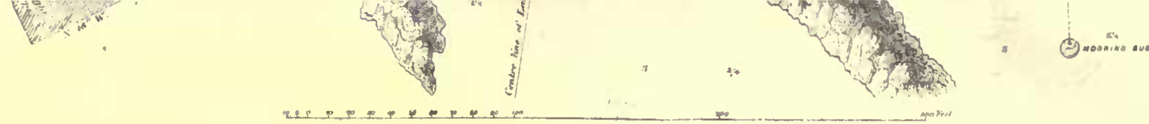
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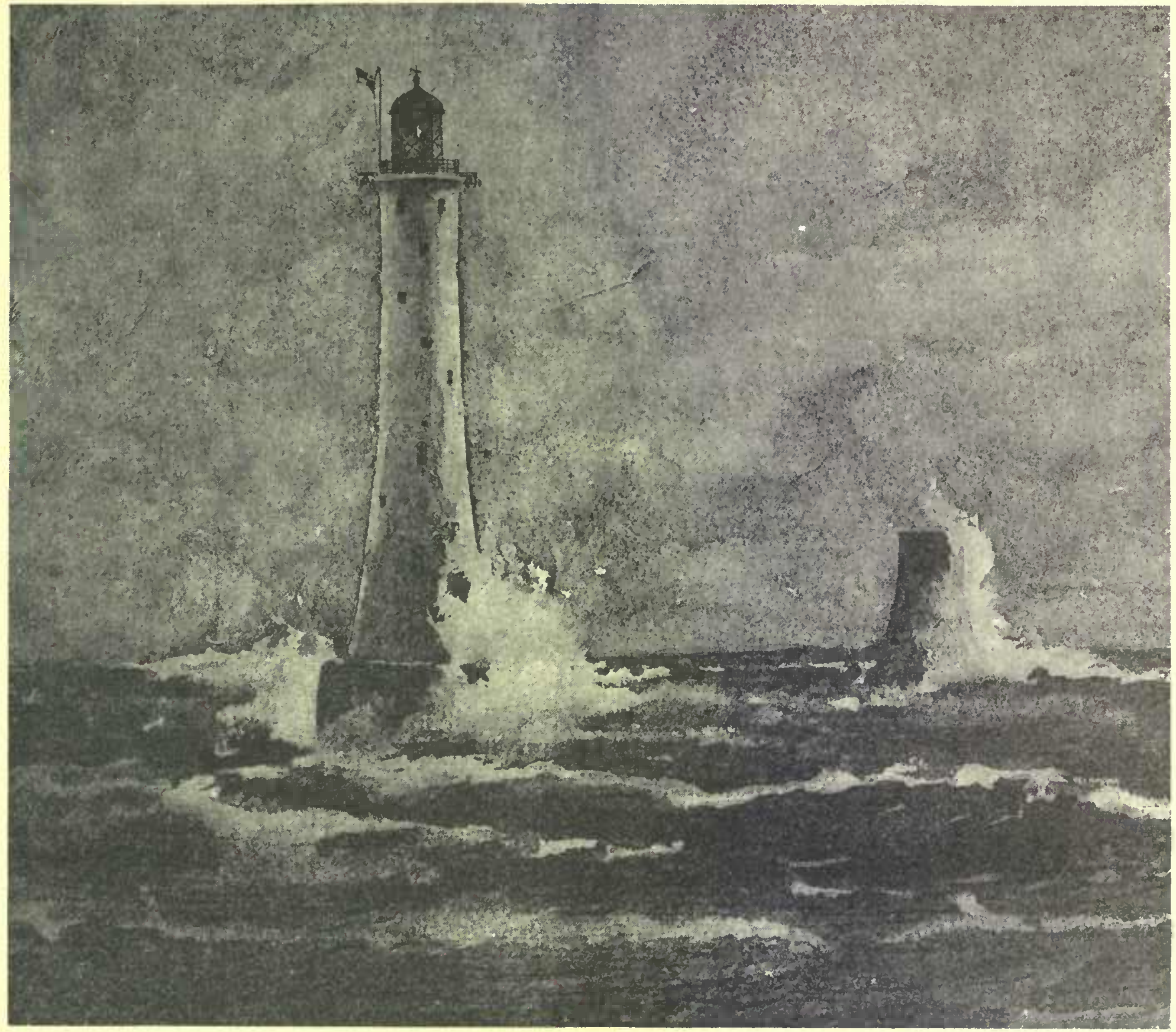


The Heliotype Printing Co. 211 Tremont St. Boston

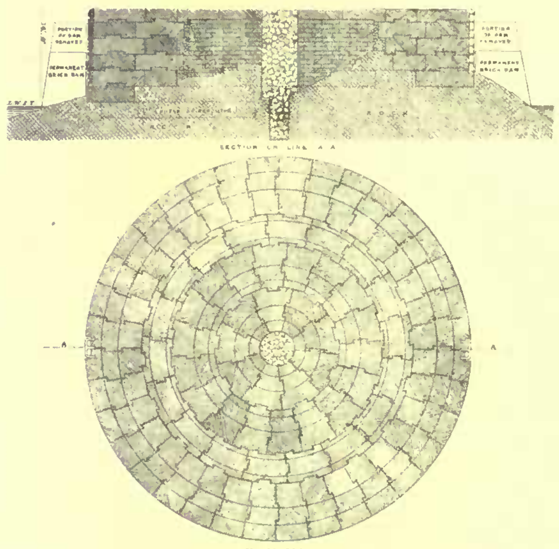
From an Etching by Piranesi.

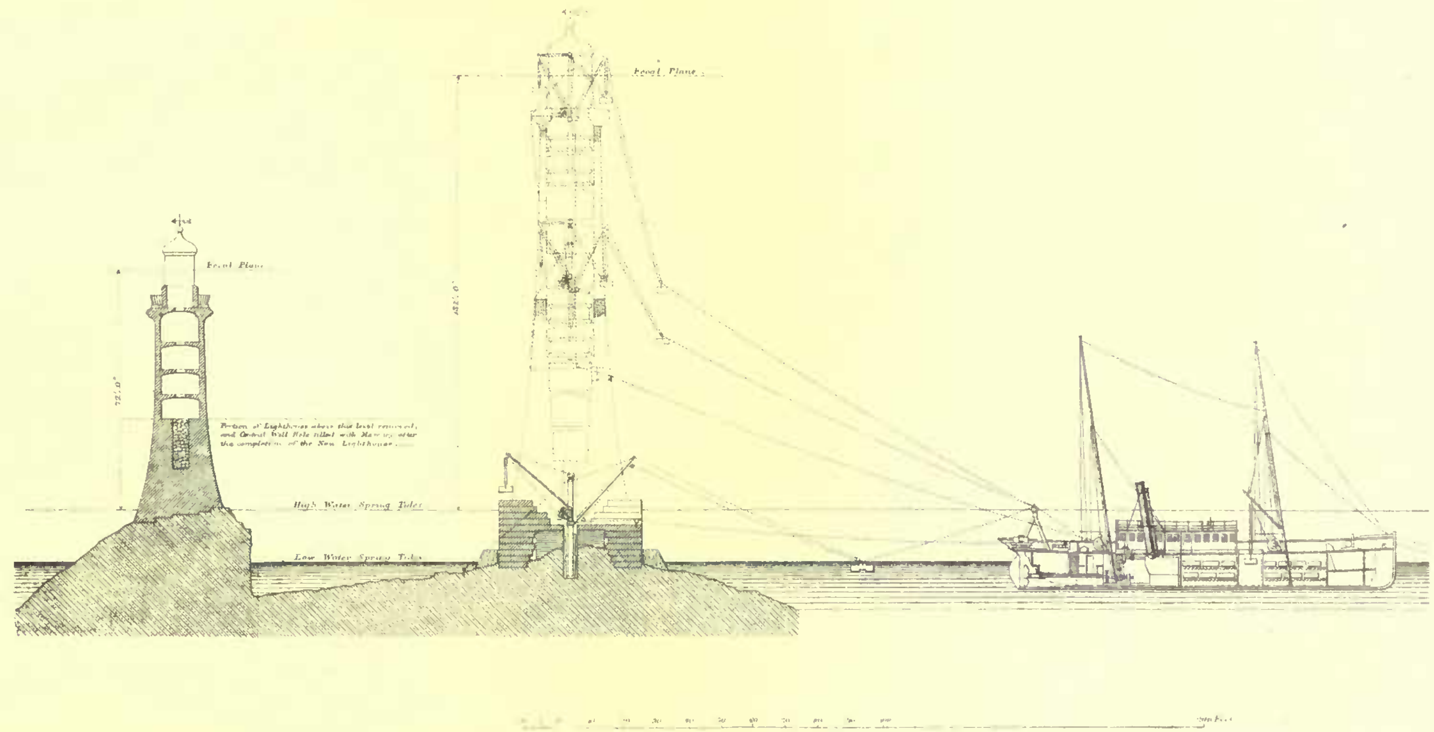






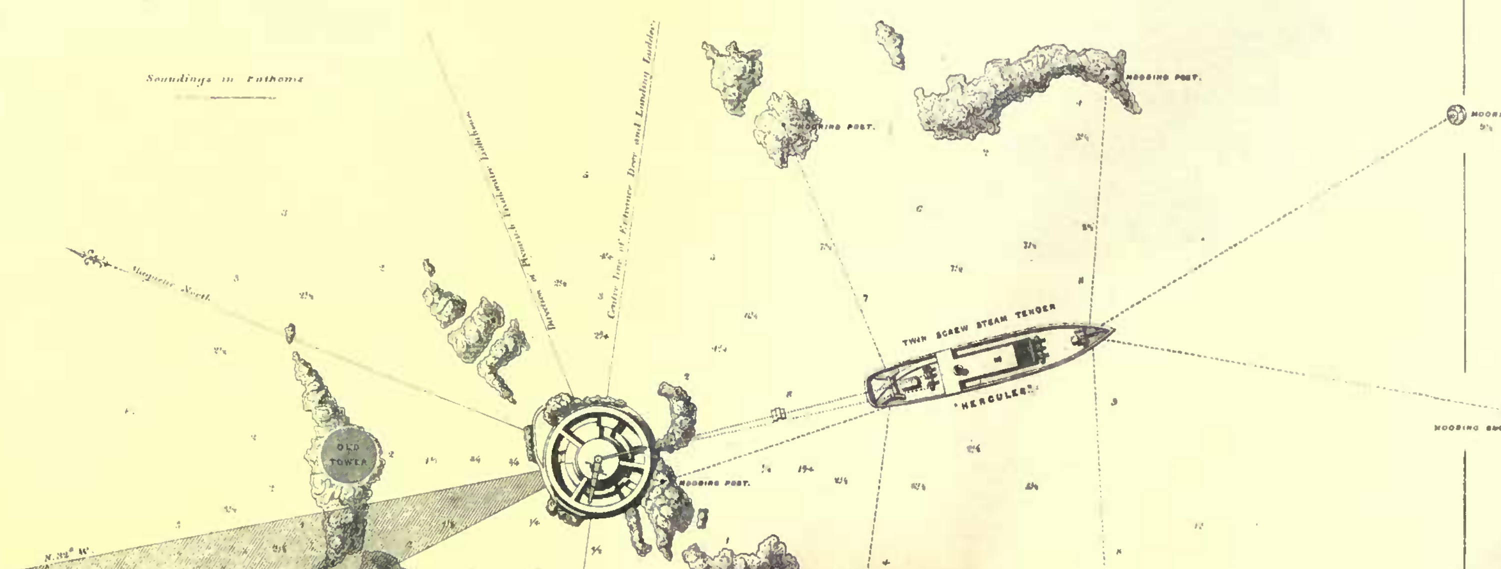
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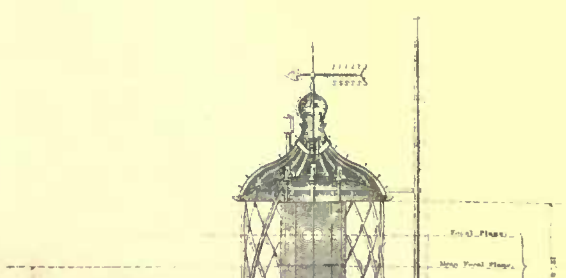




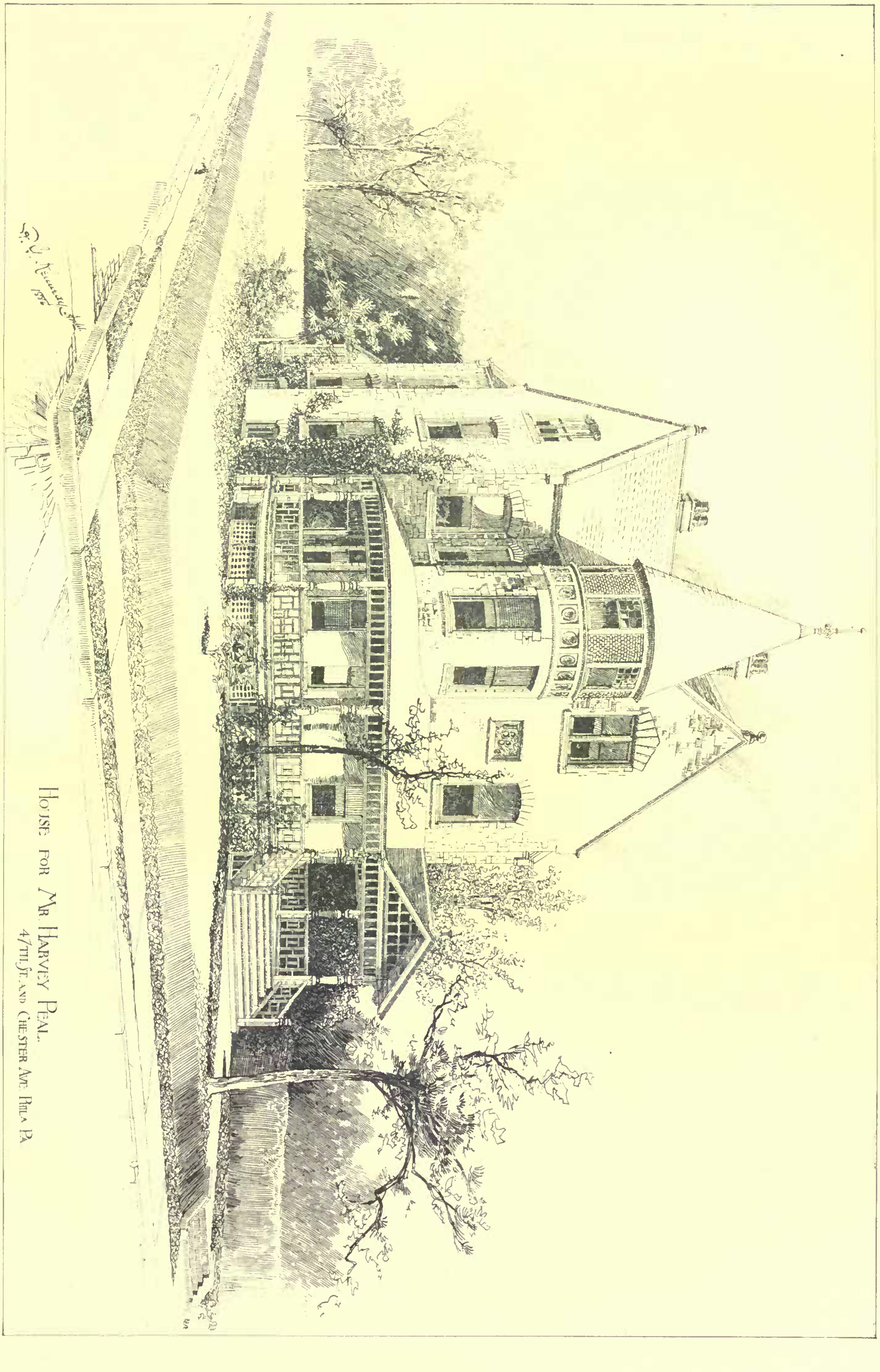
PLAN AND SECTION AT LOW WATER SPRING TIDES, SHEWING LANDING AND SETTING ARRANGEMENTS.

THE NEW EDDYSTONE LIGHTHOUSE.





American Architect and Building News, Oct. 30 1886. No. 566



House for Mr Harvey Peal.
47th St. and Chester Ave. Phila Pa



Randolph Rogers, Sculptor.

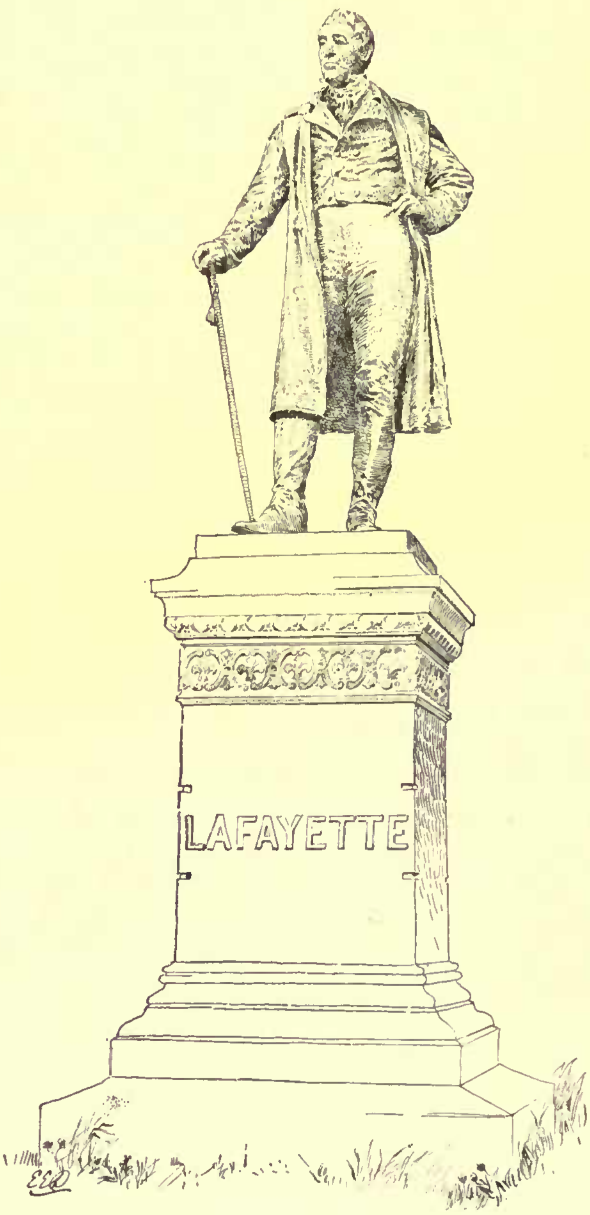




T. Crawford, Sculptor.



Lord Derby, London.
Noble, Sculptor.



J. Q. A. Ward, Sculptor.



Alonso Canos Statue of St Francis D'Assisi



Ra-em-Ke.



St. Bruno. Houdon, Sculptor.

STATUES.

be tightly secured before removal to prevent escape of offensive effluvia during transit.

[For a full description of the Goux system, as carried out at Halifax, see remarks by Mr. Councillor Pollard, Society of Arts Conference, 1877, p. 2.] The tubs are packed with screened ashes, soot (cost, 50*s.* per ton) or peat charcoal (£3 per ton), shoddy or mill refuse (cost 2*s.* 6*d.* to 7*s.* per ton), street sweepings, to which sometimes disinfectants are added. The closets are cleared every eight days, except when there is fever in a house, when it is removed every two days. The packing of each tub will absorb from six to eight quarts of liquid. It is said to work satisfactorily. The cost is about 18*s.* 6*d.* per annum per closet, whilst the material fetches from 3*s.* to 7*s.* 6*d.* per ton. Dr. Syson (Peterborough) and Mr. Haviland (Northampton) speak in favor of the system, the latter contending that where it has been adopted, the death-rate showed improvement. Any good absorbent that can be obtained at a cheap rate on the spot may be used, *e. g.*, tan. The material after emptying has little smell.

III. — PAILS USED FOR THE JOINT COLLECTION OF ASHES AND EXCRETA.

Of this method the system adopted at Nottingham is a case in point. Here the tub takes the place of the midden pit. It is to be noted that the ashes are of less quantity in summer time, when the chance of nuisance is greatest.

With respect to the mechanical appliances suggested for sifting the ashes, so as to apply only the smaller breeze to the excreta, practice proves them somewhat unsuccessful.

The compost is removed every two or three months and conveyed to the manure wharf, where it is emptied into barges and sold at a price that covers two-thirds of the cost of scavenging.

At Birmingham, where galvanized pails are used to the extent of some 40,000 (representing a population of 250,000), the contents are collected weekly. These are emptied into a vat at the place of deposit, and some sulphuric acid added to fix the ammonia. The contents are passed into a drying-machine, consisting of a steam-jacketed cylinder, within which are revolving arms, the necessary heat being obtained by burning the cinders and garbage collected in the town. The clinkers are utilized for various purposes.

The process adopted at Manchester, devised by Mr. Leigh and carried out by Mr. Whiley, was described in detail by Mr. Alliott, of Nottingham, at the Society of Arts Conference, 1877 (p. 7, also 37). The objects are (1) the disinfection of the pail contents by the use of charcoal, produced by charring street sweepings; and (2) the reduction in bulk of the matters so collected. For the purpose of reducing bulk, the liquid in the pails is drained off, and concentrated by a low heat to the consistency of treacle (about one-tenth the original bulk). The heat necessary for effecting evaporation is obtained by passing the products of the combustion of house refuse over the surface of the liquid. (Fryer's concreter.) A certain amount of sulphurous acid is thus generated, which serves to prevent the material from becoming alkaline, whilst the temperature, it is said, is sufficiently kept under to prevent loss of ammonia. The liquid thus obtained contains nine to ten per cent of ammonia. (Angus Smith.) A second variety of manure is made from the fæcal part of the pail stuff, which is also evaporated down to a certain extent. A third variety is prepared from the carbonized refuse, saturated with some of the concentrated urine, mixed with fæcal matter; and a fourth variety of manure from the fish and slaughter-house refuse, mixed with ashes, urine and fæces.

I do not propose discussing the pneumatic system of collecting excreta. In certain places on the Continent (Paris, Milan, etc.), the sewage is collected in water-tight cesspools. These are emptied by atmospheric pressure, the contents being forced into movable exhausted iron tanks, through flexible tubes lowered into the cesspool for the purpose. By this means the escape of noxious effluvia is supposed to be prevented.

The cost of removing the excreta at Paris is about £5 per house per annum. The material is converted at Villette into *poudrette*, great nuisance resulting (Society of Arts Conference, 1877, p. 14). The arrangements of Liernur (which have been adopted in Amsterdam, and to a certain extent in Prague), are, in many respects, similar. Liernur suggests cesspool tanks being placed in the middle of a street, each tank communicating with from fifteen or twenty houses.

The systems of Berlier, partly in use in Paris since 1881, and of Shone, a method of pumping sewage by small pneumatic pumping-engines, the power being generated at a central station, need only be mentioned.

As general rules we consider: —

1. That the removal of the pails should be under the control of the local authority.

2. That on an average they should be renewed once a week, a clean, well-washed pail being substituted for the full one.

3. That air-tight covers should be fitted to the pails before removal, and that they should be conveyed in air-tight vans to the depot.

The utilization of the excreta collected in pails is a matter of great difficulty.[1] At best a low class of manure results, unless some form of concentration be adopted.

Voelcker states that having examined every form of night-soil manure, he never found one having a theoretical value greater than £1 per ton, unless the manure had been specially fortified with guano, or superphosphate, or sulphate of ammonia, etc. The better varieties he valued at from 15*s.* to 17*s.* 6*d.* per ton, whilst those less carefully prepared were not worth more than from 7*s.* 6*d.* to 12*s.* 6*d.*

[1] For an account of Milburn's drying machinery, see Society of Arts Conference, 1877, p. 52.

THE EARTH-CLOSET.

The disinfecting power of earth has been known from remote antiquity. In China, the formation of a manure by mixing earth with the excreta is of ancient date.

In this country, Rosser, in 1837, proposed the admixture of urine and fæcal matter with earth, lime, etc. The suggestion took no practical shape until 1858, when the Rev. Henry Moule, the vicar of Fordington, investigated the disinfecting and deodorizing power of earth on privy soil. As the result, he invented his earth-closet. At his own vicarage, where the cesspool proved to be dangerously near the well, he abolished the cesspool, and placed buckets beneath the pans. Their contents were, in the first instance, mixed with dry sifted earth, earth afterwards being placed in the bucket itself, and the compost left to consolidate in a shed. After five or six weeks he found that the material had entirely lost its offensive odor, and was sufficiently dry to be used again. Thus eventually he not only disinfected his sewage, but produced a manure containing one-third its weight of dry excrement. The next point was the mere mechanical construction of a closet, worked by a handle, with contrivances to secure the application of a proper proportion of dry earth. The earth may, however, be thrown into the closet in one application daily, a method adopted in the latrines at Lancaster, which are under the control of the local authority.

As regards the earth best adapted for the purpose, a well-dried clayey earth, that is, a heavy soil loaded with clay, holds the first place; peaty earth comes next, although for efficiency a long way behind a clayey earth. The peaty earth used at the Wimbledon Camp in 1867 was not satisfactory, as it produced a wet and sour compost. Sand and clay are found to have very little deodorizing power, and are therefore ill-suited for the earth-closet. The clay soil must be well dried artificially (for in a damp condition its absorbent power is inferior), and after drying, powdered and sifted.

About 4½ lbs. of dry earth per head per day (*i.e.*, 1½ lbs. for each visit, three visits being allowed for each person), is required to obtain a consolidated and unoffensive compost. This quantity was ultimately used at the Dorset County Gaol, the 3 lbs. per head of earth used in the first instance being found insufficient. A village of 1,000 persons would need, therefore, about 2 tons of dry earth per day. The dry earth system was used at the Dorset County School, at the villages of Halton and Aston Clinton near Windover, in Lancaster, and at the Wimbledon Camp. In this latter case Dr. Buchanan closely investigated the working of the process.

After the removal of the earth it may be dried and returned to the closet until its manurial value justifies its sale.

As regards composition and value of the product, much will depend on the demand, and on the method adopted in working (*i.e.*, how many times the material had been used). At Lancaster the compost fetched 7*s.* 6*d.* to 10*s.* per cubic yard. At Dorset County Gaol it reached £1 per ton, and at the Dorset County School £2 to £3 per ton. Perhaps 10*s.* per head of the population annually might be taken as an approximate value.

The dry-earth system has certain definite advantages over the water-closet. The first cost is less. It reduces the quantity of water required by each household. The closet is less liable to go wrong, to suffer injury from frost, or to be damaged by improper substances being thrown into it. No doubt an intelligent person can manage it, but if it be used in villages it should be managed by the local authority, easy access to the closets by the scavengers being, in such case, indispensable. Of course, a dry-earth system does not supersede the necessity for some independent means of removing slops, rain, and subsoil water.

A still further advantage claimed for the earth-closet is the manurial value of the compost, and the ease with which it may be stored until required.

No doubt the earth-closet has its objections. Of these, a certain filthiness (real or imaginary), and the difficulties of supplying the necessary quantity of dry earth and of removing the compost, are those chiefly urged. No doubt the collection of material that may be more or less foul as the closet has or has not been attended to by the scavengers, and the after distribution of the compost, compare, at first thought, unfavorably with the cleanliness of water, and the ease with which it serves to convey the filth from the closet to the field. But this assumes (1st) no misadventure of the water-carried sewage between closet and field; (2d) a farm and a crop ready at all times and seasons — wet or dry, summer and winter — to receive and to appropriate it; and (3d) no escape of noxious effluvia and miasms, no spread of disease, and no pollution of water courses. How far such assumptions are realized I shall consider presently.

Earth-closets have been largely used, and their use is rapidly extending in India, where the drying of the earth is a comparatively easy process. The authorities in India, in 1867, reported to the Secretary of State that Moule's system, which was then generally employed in the barracks, gaols, hospitals, and public institutions of the three presidencies, had been found to be a great public benefit. I can, myself, bear testimony to the excellent results of the dry earth

system where the closets are properly attended to — proper earth used — and the materials properly dried.

ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

Note:—After our text pages had gone to press last week we found that Plate XXX of the series of the Rotch Travelling Scholars, issued only with the Imperial edition, promised to be so unsatisfactory that we decided to withhold its publication until a better impression could be secured.

EARTHQUAKE EFFECTS AT CHARLESTON, S. C.

[Gelatine print issued only with the Imperial and Gelatine editions.]

By the kindness of Messrs. Walker, Evans & Cogswell, of Charleston, S. C., we are allowed to reproduce these views from the interesting collection of similar views published by them.

THE NEW EDDYSTONE LIGHT-HOUSE.

For description see our issue for October 9 last.

THE ARCH OF CONSTANTINE, AFTER AN ETCHING BY PIRANESI.

It will be interesting to compare this plate with the photo-caustic print of the same arch published in our issue for July 10 last.

HOUSE FOR HARVEY PEAL, ESQ., CORNER OF FORTY-SEVENTH STREET AND CHESTNUT AVENUE, PHILADELPHIA, PA. MR. R. G. KENNEDY, ARCHITECT, PHILADELPHIA, PA.

A COUNTRY HOUSE. MR. JOHN CALVIN STEVENS, ARCHITECT, PORTLAND, ME.

EXTRACTS FROM PRIVATE LETTERS RELATING TO THE CHARLESTON EARTHQUAKE.

Charleston, September 2, 1886.

My dearest L. — You will see by all the papers the terrible earthquake which has visited the whole South, and I have sent yesterday's Charleston papers to H. with imperfect accounts of its ravages in this city. Painful as they are, the paper tells but a portion of the calamity, and none was issued to-day, on account of the ruinous condition of the building, which makes them fear to use the heavy printing-press. Many lives have been lost, and people are in an anxious and unsettled state; but you will rather hear of ourselves, so I begin from the beginning of our own experiences. The afternoon was extremely sultry. Neither on Mr. Y's piazza nor on the Battery, where we went to find a car, was there a breath of air. We sat down on the Battery to admire the sunset; the clouds looked heavy and sulphurous. B. said they seemed to have a storm in them. The whole evening was sultry. B. and W. sat down to their lessons, and I, being tired, bade them good-night and went up stairs. I walked to the north end of the piazza and looked down the street; then, turning to go into my room I heard a heavy rolling sound, and immediately after felt the violent rocking of the earth, and caught hold of the little door to support myself. It moved backwards and forwards in my hands; then the room filled with white dust, and I looked to see if the plastering had fallen. Just at that moment J., who had been in bed, rushed into the room and seized hold of me, and I heard E. scream, "Oh, save my child;" then she and D., with K. in his arms, seemed to stop right at my door. They were all in their night-clothes and completely bewildered with fright, yet waiting for me to go first. I heard myself say, "take the child down," and J. ordered them to go down, and they rushed into the yard and we followed. W. said he thought it was a tornado, but he got B. out into the yard, then ran back and caught K. out of D.'s arms; but where was uncle J.? I went back to call him and found him making a leisurely toilet after a bath, and apparently the coolest of any of us. W. and B. went up into the second story and gathered shawls, shoes, etc., for those in need of them. We stood, and afterwards sat in the yard until there seemed a respite from the shocks — the servants with us — then we went into the piazza and sat during the night there or in the dining-room. K. slept a little on the sofa, though the least sound awoke her, and I think was more excited than frightened, though some heard her praying softly in the yard, "please, dear Lord, don't let the dreadful thing come again." Dreadful it really was; I cannot describe the sensation, and could only express it as, Oh, how awful! applied only to the dreadful rocking motion. After a while we went out in front to see the condition of things; several of our neighbors came to us, for the rush had been to the wide streets, and groups of negroes were gathered, some praying or singing very earnestly, but with a subdued excitement very unlike their usual noisy zeal. The whole of Aikin's Row rushed to the park and spent the night there in the open air; some improvised tents by throwing bedspreads or pieces of carpet over a support, as shelter for the children; none ventured to go back into their houses; all the chimneys and many walls were shattered, especially the out-buildings; some of the houses were quite unsafe. As we were kept in constant excitement by the recurring shocks we spent a great part of the next day on the parks, and arranged to spend the night there; Mr. M. had got a long canvas and offered us a portion of its shelter; we sent out two lounges, etc. Ellen and Dick [1] were dreadfully alarmed, and would hardly enter the house for more than a few minutes at a time, though thus far our injuries are light compared with many, and we were mercifully preserved from fire, for, although our entry lamp fell over and shade and lamp were broken, while we were out of doors, it must have gone out in the fall. Many houses caught fire from this cause, and there were several large fires in the city to add to the misery of the night; fortunately, it was deathly still, which saved the fires from spreading. Our chimneys are all down and our plastering very much cracked, but they think the walls are secure, which is a great comfort. We spent two nights camping, but hope to stay at home to-night unless there is further alarm. Dr. Wilson, of St. Luke's church, and Mrs. Wilson, were like good spirits in our camp, so kind and sympathizing to every one. The doctor held a little service every night; on the first he made a short address on the dreadful peril which had brought us all together, said a few of the church prayers and the creed, and then Mr. Burgess made a solemn prayer. Through all of this my heart was with our darling K., so separated from us, and with her sick husband, and hearing the dreadful rumors from Summerville where her home and children are yesterday morning B. and T. determined to go to her. We took the East Bay cars and passed down through great destruction on each side to Tradd Street, when we got out and walked through the narrow streets filled with brick and mortar, houses apparently ready to fall on either side, so that we were glad to reach the wide space of Meeting Street, though that section is a mass of ruin, the Guard House down, and St. Michael's torn and riven in all directions. The Scotch church looks as if crumbling in every part, and the destruction is heart-sickening to look at. . . . H. came to us this morning with the dreadful accounts from Summerville, where the earthquake was at its height, and scarcely a house has escaped partial or entire destruction. Mrs. P.'s house is a wreck, and our dear H. is without a home.



Soldiers' Monument (bronze statue) Forest Hills Cemetery, Mass.

J.'s is more severely wrecked than any — the great, strong chimneys coming down with a crash; you see how none can help the others except by sympathy. All the Summerville people are camping; the shocks still continue there, though lessened in force. They think Summerville is the centre of the earthquake. The M.'s house is down, and poor C., in her sickness, is sitting in the street. They all camp out, but it is so still to-day I hope they will make some better arrangement. J. G.'s house is so safe that J. is acting the Good Samaritan, and has mattresses spread for the many who come to her begging leave to rest there for a little while, some bringing their children. Some of our friends have sought shelter in boats. . . . The upheaval in Summerville was very great. Three springs of clear, sweet water burst up in J.'s yard, though their well filled to the top with horribly-smelling black mud. In our yard in Charleston little holes opened, throwing up water with yellow sand.

In the street was quite an opening from which water and sand were thrown out and flowed some distance. This occurred in many places. A man told me it was hot water, but it was not so when I put my hand in it by daylight.

But you will be weary of these details. From your loving

Mother.

Summerville, September 3, 1886.

My dear C. — I feel that I must write to you and let you know how we got off in our fearful visitation of the 31st of August, when we all expected in a few seconds to be launched into eternity. I am thankful to say we all escaped and succeeded in getting out almost in a

[1] Negro servants.

miraculous manner with the eleven little ones. It is useless for me to tell you that our home is a perfect ruin, and N.'s in so dangerous condition from the cracked chimneys that she, with her little ones, is in our yard. I had been sitting the evening with her, and had just entered our yard when the earthquake struck us. I got no further than the front door, and could only cling to it for support, L. rushing to me and throwing her arms around me, expecting to be killed any second (which seemed longer than minutes) by the falling timbers from the piazza.

When morning came we found every chimney down, all the brick pillars down or cracked throughout, and all that was keeping up the house was a few blocks which S. had put up last summer to support a weak sill, and "The everlasting arms," which are always around us. As soon as S. could get help he propped up the house with temporary blocks to try to save it from further ruin.

When God sends to man a visitation like this, he puts it into the hearts of his people to send relief, and I know your city will not be behind in sending help to Charleston. What I want you, dear friend, to do is, to let them know of our utter ruin, that we, too, may get some help, for without it I do not know what is to become of us, individually. I am so affected that I do not know how I have worded this letter. As I write I can hear from the earth the same sound as during the bombardment of Charleston. . . .

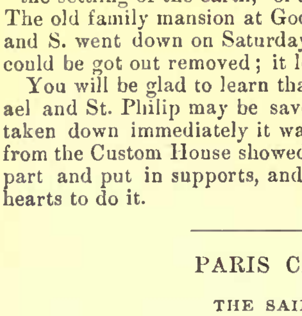
SUMMERVILLE, September 28, 1886.

Thank you, dear A., for your sweet letter, so full of sympathy. Our community is, as a general thing, calming down, but yesterday afternoon, at five o'clock, we had a sharp shock, which unnerved us all for a little while. When a shock passes off I feel so thankful that it is over without further damage. S. tells me that in the country, on the Ashley River, about fifteen miles from here, the ground is ploughed with furrows, and in one place his horse's feet sunk so deep in the bed of sand thrown up from the fissure that he would not venture nearer than about four feet, so could not see from there the depth of the opening, and that extended about half a mile in ridges up and down. The people are gathering up the sand, gravel and other things which have come up. Some pieces shown me resemble old pottery, but I did not see anything of that kind from the openings in Summerville. I wish you could see them; they are curiosities. The pieces I saw were got at Lincolnville, just below our railroad depot. . . . We are still sleeping in our out-houses. I think I wrote you that S. and M., with their six children, are in the storeroom; L., with her five, in the old kitchen. Mrs. S. has a tent pitched in our garden, where she sleeps at night with her five children. So you see we are quite a little settlement — sixteen children in all. We have a light in the yard and the children have a splendid time camping; we old folks sit under the large trees and talk over our experiences. But you must not think us woe-begone under our trials, for every one bears up with patience and cheerfulness, hoping it is over, and believing the noises and shakes we still have "the settling of the earth," or anything else the scientific men tell us. The old family mansion at Goose Creek (built in 1690) is destroyed, and S. went down on Saturday and had as much of the furniture as could be got out removed; it leaves them without a home.

You will be glad to learn that it is hoped the steeples of St. Michael and St. Philip may be saved. They thought the latter must be taken down immediately it was so unsafe, but some smart engineer from the Custom House showed the people how to cut out the injured part and put in supports, and they found strong arms and willing hearts to do it.

PARIS CHURCHES. — II.

THE SAINTE-CHAPELLE.



LOUIS IX, King of France, died on the 25th August, 1270, twenty-two years after the consecration of the Sainte-Chapelle, a building as perfect amongst churches as the King was perfect amongst men. His love of his mother was intense, and reflected well upon her for the careful way in which she had brought him up. A touching anecdote is recorded of Queen Blanche, which would make an excellent subject for an historical picture. It is related that one day at the court the Queen noticed a beautiful youth with long, fair hair, and asking who he was, she was answered, "Prince Herman, the son of the sainted Elizabeth of Hungary." On hearing this, Queen Blanche rose from her seat, gazed at the youth, and said to him, "Fair youth, thou hadst a blessed mother; where did she kiss thee?" The youth blushing, replied by placing his finger on his forehead between his eyes. Whereupon the Queen reverently pressed her lips to that spot, and looking up to Heaven, breathed an invocation, "*Sancta Elizabeth, Patrona nostra dulcissima, ora pro nobis.*"

It must be remembered that in the Middle Ages humility was a virtue which was highly cultivated. When we read of St. Louis carrying the holy relics from Sens to Paris, barefooted, we must look upon it as a practical demonstration of real feeling. In these days we are apt so much to pray in our closets, and to do our alms away from the sight of men, that it is sometimes doubtful whether we pray or give alms at all. In St. Louis's time this was not so, and even Voltaire sums up his character by saying, "*Il n'est guère donné à l'homme de pousser la vertu plus loin!*" Gibbon, too, allows that he united the virtues of a king, a hero, and a man. There is no evidence whatever, to prove that he was simply a fanatic, or in any degree a hypocrite. He was of a highly religious temperament, and an enthusiast; and he remodelled his conduct upon his ideal of what the life of a Christian prince should be, practising in all simplicity what he preached; a very rare virtue in these latter times.

Before the reconstruction of the eastern part of the Palais de Justice under Louis XVI, an elegant little edifice was attached to the chapel, which served as its sacristies. In the upper one were strong closets, containing the treasures which had accumulated since the days of St. Louis.

The first stone of the church was laid by St. Louis in 1245, and three years later, on the Sunday after Easter, Quasimodo, 25th April, 1248, it was consecrated by the Pope's legate Eudes de Châteauroux, Bishop of Tusculum, under titles of the Chapel of the Holy Cross and the Holy Crown. On the same day, Philippe Berruyer, Archbishop of Bourges, celebrated the same ceremony in the lower church, putting it under the patronage of the Blessed Virgin. It seems strange that Joinville should not speak of this event, and yet it must have been an imposing sight; but he does not once mention the Sainte-Chapelle in his life of St. Louis. Perhaps this may be accounted for by what he thus relates. "At Easter-tide, in the year of grace 1248, I summoned my vassals and retainers to Joinville, and on the Easter-eve . . . was born John, my son, Sire d'Ancarville. . . . We had feasting and dancing all that week, in the course of which my brother, the Sire de Vaucouleurs and other rich persons who were there gave banquets one after the other on Monday, Tuesday, Wednesday and Thursday;" and then he goes on to say, that he went to Metz on business before he started for the Holy Land; therefore we may suppose that private affairs kept him away from Paris, and that not being present himself, he did not consider it necessary to give an account of a ceremony that he did not witness.

Two charters dated Paris, 1245, and Aigues-Mortes, 1248, respectively, give the terms of the endowment by the King. The number of ecclesiastics who first formed the college was fixed at twenty-one; five principal priests or *maîtres chapelains*, each having an assistant chaplain, priest and a deacon, and three beadles who had as many clerks under them. The number was modified from time to time, during five centuries, and latterly it consisted of a treasurer, twelve canons and nineteen chaplains. The office of treasurer was generally filled by some important personage, and he had the privilege of wearing the mitre, and other insignia of the episcopate, and of giving the Benediction upon great festivals; but he was not allowed to bear the crozier.

Pierre de Montereau lived eighteen years after the completion of his *chef-d'œuvre*, and doubtless assisted at some of the splendid ceremonies held in it. He died March 17, 1266, and was buried in the chapel of the Virgin belonging to the religious of St. Germain-des-Près, where a splendid monument was erected to his memory. Some of the finest buildings belonging to the convent were his work; and up to the last century a stone was to be seen over his burial-place upon which he was represented with a rule and compass in his hands. His epitaph gives him the titles of *fleur pleine de bonnes mœurs* and of *docteur des architectes*. Another stone recorded the name of his wife Agnes, and on that he is termed, in old French, *mestre Pierre de Montereul*. The chapel has disappeared, and with it all trace of the tombs; but the one at Reims, erected in honor of Hugues Libergier, architect of the celebrated abbey church of St. Nicaise, who died in 1263, gives us some idea of what those of Pierre de Montereau and his wife must have been.

The most important event of the thirteenth century connected with the Sainte-Chapelle was the translation of St. Louis's bones from St. Denis, where they had been laid twenty-seven years before, on their arrival from Tunis. They had been placed behind the altar of the Trinity, near the tomb of Louis VIII, and of Philippe Auguste. The bull of canonization was promulgated by Pope Boniface VIII in 1297, and in the following year the body was exhumed and enclosed in a silver *chasse;* but it was not until 1306 that Philippe le Bel succeeded in placing the remains of his ancestor in the Sainte-Chapelle. The translation took place in the May of that year, accompanied by all the picturesque pomp of the fourteenth century. The fifteenth of May, 1843, an interesting discovery was made in the chapel. Some workmen, in lifting a stone of the pavement of the apse, found a box containing the remains of a heart, and a *procès verbal*, stating that it had previously been discovered on the 21st January, 1303. Although the spot where it was found indicated that it had belonged to some distinguished person, yet there was no clue to its owner — no inscription, or name, or date. The box was in the style of the thirteenth century, but it is seemed doubtful that had the heart been that of St. Louis, such an important relic would have been lost sight of, and no record of it have been given by the Benedictines at St. Denis in their inventory of treasures. The matter was referred to the Académie des Inscriptions et Belles Lettres, and fully discussed, but no decision could be arrived at, and consequently the box was replaced where it was found.

While the Kings resided in the Cité the most brilliant ceremonies succeeded one another in the Sainte-Chapelle; it was, in fact, the chapel belonging to the adjoining palace — now the Palais de Justice. The Queens Marie de Brabant, second wife of Philippe le Hardi, Marie de Luxembourg, second wife of Charles le Bel, Jeanne d'Evreus, third wife of the same prince, and Isabelle de Bavière, wife of Charles VI, were all crowned here. The marriage of the emperor Henri VII and Marguerite de Brabant, and the betrothal of Isabeau, eldest daughter of Charles VI, and Richard II of England were also solemnized here. Here, in 1332, Philippe de Valois held a great assembly of prelates and barons, to announce his project of another crusade against the Infidel — a project which was never carried out. On the feast of the Epiphany, 1378, Charles V, the Emperor Charles IV, and his son Wenceslas, King of the Romans, offered gold, frankincense and myrrh, after the manner of the three Holy Kings. Every time that the sovereigns convoked an assemblage of the clergy, the prelates first asked the blessing of the Holy Spirit, while prostrated before the relics. In 1483, when Louis XI was dying, he hoped to prolong his life by surrounding himself with the most sacred relics of his kingdom — so reluctant was this *dévot* to die! The holy Ampulla was brought by the religious of St. Remi from Reims; the canons of the Sainte-Chapelle took the Cross of Victory and Moses's Rod out of their treasury, and a grand procession of clergy and laity was formed on August 1, to carry them from Paris to Plessis-les-Tours. But alas! to no end; for on the 30th of the same month the poor creature finished his earthly career of hypocrisy.

Boileau gives an amusing account in his poem, "Le Lutrin," of an unseemly squabble between the canons. One Sunday, in 1667, one of them, who was a singer, found a huge desk placed in front of his stall. He protested against it, and the other canons took his part, ordering it to be removed. But the treasurer took the part of the beadle who had placed it there, and the discussion waxed fierce. Thereupon the decision of the president was demanded — one Guillaume de Lamoignon, and the end of it all was that the singer consented to abide behind the desk an entire morning during mass; and the treasurer, satisfied by the acknowledgment of his authority, had it removed before vespers.

An order of the Conseil d'État, dated March 11, 1787, sequestered all the goods of the chapel, suppressed the chaplaincies and canonries, and ordained that the services should be continued by the king's ordinary chaplains. Three years later it shared the fate of all the abbeys, chapters, and religious foundations, and soon after St. Louis's beautiful chapel was closed. The relics were sent to St. Denis, in honor, to be brought back later on in dishonor, and the other objects were dispersed to the national museums. *Propriété Nationale à Vendre* was written up on the building, a piece of information which has only disappeared in our time. Under the Directoire a club held its meetings there, and later it was converted into a warehouse for corn and flour. Towards 1800 a few ecclesiastics hired it and celebrated mass there, but in 1803 it was further profaned; the upper chapel was turned into a depository for the archives, and the lower one became the dépôt of the Cour des Comptes. In vain Louis XVIII and Charles X tried to restore it to its proper use; and it was only in 1837, in the reign of Louis Philippe, that its restoration was decided upon. MM. Duban, Lassus, Viollet-le-Duc, and Bœswilwald were commissioned to undertake the work at a cost of 2,000,000 francs, a sum nearly equal to the original value of the treasures (2,800,000 francs), while it exceeded by nearly two millions the original cost of the building — 800,000 francs. The 3d November, 1849, the work was efficiently advanced for the ceremony of the institution of the magistracy; and each succeeding 3d of November a mass has been said, accompanied by the original chants in use in the chapel in former times, and in presence of the judges and members of the Palais de Justice. This is the only occasion on which any religious ceremony is held there.

Some strange customs prevailed in former times, connected with the chapel. On the feast of the Holy Innocents, the acolytes were in the habit of vesting themselves as canons, and receiving homage as such — a custom of travestying holy offices which prevailed in many churches in the Middle Ages.

On the Good Fridays of each year the chapel scarcely sufficed to contain the crowds of sick persons who flocked to it from all parts of the city. All maladies were supposed to be curable through the virtues of the holy relics, but specially that known formerly as *le mal caduc*. At midnight the cross was exposed, and at the same moment the chapel was filled by the most fearful shrieks. The afflicted threw themselves about, foamed at the mouth, and fell into convulsions, invoking the aid especially of St. John the Baptist and St. Spire. The people were convinced every year that some wondrous miracle had been wrought; but the abuses were so great that in 1781 Louis XVI interdicted the nocturnal exposition of the cross. At the present time the legendary relics of the True Cross and the Holy Crown are exposed at Notre Dame during Holy Week, and carried in procession on the evening of Good Friday. It is not known when the archives were first installed in the treasury of the Sainte-Chapelle; but in 1615, when an inventory was drawn up by Pierre Dupuy and Théodore Godefroy, there were three hundred and fifty drawers, two hundred and sixty registers, fifty-two bags, forty-two shelves and fifteen coffers. This inventory consists of eight volumes of manuscripts in folio. In 1783 the sacristy was sacrificed to the love of symmetry in the new *cour d'honneur*, and the archives were removed to the Chancellerie du Palais. At the present time some of them are in the Bibliothèque, but the greater part are at the Archives Nationale in the rue Rambuteau.

The state of dilapidation into which the chapel had fallen when the restoration was commenced was terrible. The tracery of the windows was destroyed, the glass was broken and filled up with plaster, the *flèche* and gargoyles had disappeared, and the interior was filled with shelves and woodwork for the storage of the archives.

It was the same class of destruction that had taken place in the chapter house of Westminster Abbey, and which makes us wonder if our ancestors were deficient in all love of the beautiful.

The dimensions of the building are as follows:

Length of exterior	36	metres.
Length of interior	33	"
Width of exterior	17	"
Width of interior	10.70	"
Height of exterior from the ground of the lower chapel to the point of the gable of the façade.	42.50	"
Height of the *flèche* to the summit.	33.25	"
Height of the vault of the lower chapel under the key-stone	6.50	"
Height of the vault of the upper chapel	20.50	"

M. Viollet-le-Duc in his "*Dictionnaire raisonné de l'architecture*," thus describes the building: "*De la base au faite, l'édifice est entièrement construit en pierre dure de choix, connue sous le nom de liais cliquart* (*Portland stone*)*; chaque assise est cramponnée par des agrafes de fer coulées en plomb; les tailles et la pose sont exécutées avec une précision rare; la sculpture en est composée et ciselée avec un soin particulier, sur aucun point ou ne peut constater ces négligences qui ne sont que trop souvent le résultat de la précipitation.*" At page 401 of the above work is an explanation of the system of courses employed by Pierre de Montereau; a manner of strengthening which was in use before the masonry — thirteenth century — but which was improved upon by the architect of the Sainte-Chapelle. It is very similar to the system now in use.

The only communication between the lower and upper chapels at the present time is by means of the small turret staircase; but formerly the upper church was approached by a wide exterior flight of forty-four steps. It was reconstructed many times, and the last, in Egyptian style (!) was dated 1811. The demolition of this is no cause of complaint, but it seems a pity it should not have been replaced by one in better taste, as the only approach to the upper chapel (except the turret stairs) is through the corridors of the Palais de Justice.

The first thing that strikes the visitor is the enormous size of the windows, which occupy the entire space between the buttresses, and rise to the base of the roof. All the weight of the vaulting rests, therefore, upon the exterior buttresses, but not the slightest flexure has ever taken place. The church is built truly east and west. The entrance to both chapels is by two portals. The only modification the exterior of the building has sustained since St. Louis's time is the addition of a little oratory attributed to Louis XI, and the rebuilding of a part of the façade in the fifteenth century.

The porch of the lower chapel is divided into two bays by a pier, on which is a statue of the Blessed Virgin, while above in the tympanum is a Coronation of the Virgin. This and the entire ornament of the doorway is the work of M. Geoffrey Dechaume. The original statue had the reputation of working miracles; and it is related that when, towards 1304, Jean Duns Scot, a celebrated theologian of the University of Paris, was praying at its feet, it bent its head in approval of the doctrine of the Immaculate Conception, which that learned doctor taught, and that since that time it always remained in the same position. The portal of the upper chapel is of the same character as the lower one, but richer in its decoration. It is nearly all new, for the old had not only been mutilated, but completely chiselled off. The subject in the tympanum is "The Last Judgment." The voussoir is a mass of sculptures — single figures, groups, and ornament. The figures are forty-four in number, and complete the central subject: angels conducting the elect to heaven, angels censing and bearing crowns, martyrs with the instruments of their passion, and the damned surrounded by the flames of hell. Happily the sculptor had some old work upon the portals of Notre Dame and St. Germain l'Auserrois to study, and the execution is a marvel of patience and knowledge. Each figure has been fitted into its place upon the lines of the original, wherever any trace was left.

The plan of the church is a parallelogram, terminating in a polygonal apse. The buttresses reach to the parapet, and terminate in pinnacles surrounded by gargoyles, ornamented with the most grotesque beasts. The windows of the nave are divided into four lights, with foliated circles in the heads very similar to those of the chapter-house at Salisbury. The first *flèche* fell in the reign of Charles VI; the second was burnt in the great fire of 16 July, 1630; the third was erected by Louis XIII, in the ogival style of that period, and remained until the seventeenth century. When it was destroyed, in 1791, it contained five bells which had been cast in 1738 — the Dauphin, the Duc d'Orleans, the Duc de Chartres, and the first President of the Chambre des Comptes being their sponsors. The present *flèche* was erected in 1853, and is in the style of the fifteenth century. It is wood covered with lead, and consists of three octagonal stories supporting the spire. On the lower story are colossal statues of the twelve apostles. The St. Thomas is a portrait of the sculptor Lassus. The gables of the upper story support angels with the instruments of the Passion. The crockets of the spire are *fleurs-*

de-lys, and the whole is resplendent with gilding. The summit of the *chevet* is surmounted by a huge angel holding a processional cross. There was an idea, never carried out, of making the statue turn round mechanically upon a pivot during the twenty-four hours, that it might present the symbol of salvation successively to all quarters of the city. The statues are all portraits — so, too, are the masks — the portraits of the artists and workmen engaged on the work of restoration. The oratory erected by Louis XI, between the two buttresses of the fourth bay on the south side, is easily distinguished from the thirteenth-century work.

The vaulting of the lower chapel is supported by fourteen columns. At the east end is a *chevet*. The bosses are of wood. The two columns without capitals were added at the same time as the apsidal tribune in the upper chapel. The decoration is in imitation of the original thirteenth-century work. In removing the remains of some later work in a style utterly at variance with the architecture, by Martin Fréminet, painter to Henri IV and Louis XIII, a little of the original painting was discovered. This is a fragment of an Annunciation. In 1691 the tracery of the windows and the stained-glass were destroyed and replaced by white, to give extra light. The pavement is a mass of inscriptions, almost the only ones which exist at present at Paris; but the whole floor is laid with mattings, so that it is impossible to study them. Formerly there were seven altars and a font in the lower chapel, and Boileau, whose father had a house in the court of the palace, was baptized there in 1636.

The upper chapel is one of those buildings which one never tires of admiring. When we wind our way up the turret stairs, and enter it from semi-darkness, it strikes us as the most exquisite blaze of color imaginable. Add to the beauty of the chapel all the associations which crowd upon one's memory — St. Louis's beautiful faith and noble life, his enthusiasm for God's work and man's welfare, all the ceremonies and processions, the lights, the flowers and the incense — and one's imagination forms a picture that no hand could adequately paint. The chapel is composed of four bays for the nave, and seven smaller for the apse. The vault is groined and is supported by clustered columns; the capitals are ornamented with foliage. The windows occupy the entire space between the supporting columns, and are filled with most beautiful stained-glass, while below them is an arcade supported by a stone seat. The capitals of the columns are most exquisitely carved in imitation of the flora of France; the quatrefoils between the arches being filled with a kind of decoration which is as rare as it is effective. The designs were drawn upon the stone, and the backgrounds filled in with incrustations of blue glass and gold. The subjects are taken from the lives of the martyrs. Most of them have been restored; but very wisely, two or three have been left in the state in which they were discovered. Between the arches of the arcade are angels with outstretched arms, who seem to be crowning the martyrs in the quatrefoils. At the third bay of the nave on each side are recesses which formed reserved places for some privileged persons during mass; and it is thought that they were probably occupied by the king and queen — the former on the gospel, the latter on the epistle side. On the south wall is a slanting recess, which formerly must have served as a chapel, as there was an altar at the end of it, having a painted reredos representing the interior of the great *chasse* with all its contents ranged in proper order, and St. Louis praying before it. It is supposed that Louis XI may have used this niche as a place where he could pray, and see the altar and relics, without being seen himself.

It was always the custom, at the consecration of a church, to place a cross wherever the sign of the cross had been made by the bishop. The architect of the Sainte-Chapelle conceived the happy idea of placing the twelve Apostles as pillars of the church, supporting these crosses, which are in the form of monstrances. The pedestals on which the figures stand are affixed to the pillars. The statues, like the entire church, are painted and gilt, and those of the thirteenth-century are marvellous examples of the sculpture of that period. After the closing of the chapel, these statues were sent to the Musée des Monuments Français; but when the Museum was suppressed, they were dispersed or broken up. St. Peter was discovered in fragments in St. Denis; another was given to the church at Creteil, where it passed as St. Louis; four were given to the missionaries, for their Calvary at Mt. Valérien. These were in perfect preservation and the color had not disappeared. They remained at the entrance of one of the chapels of the Way of the Cross until 1830, when some senseless vandals threw them down and broke them. All the fragments that remained are now in the garden of the Hotel Cluny, a "museum of fragments." The rest were replaced in the chapel, and are the fourth and fifth on each side facing the altar. The others are new.

The pavement is modern incised stone, with erustations of color, and representing geometrical patterns, animals and flowers. In the apse are subjects, the four rivers of Paradise and the seven sacraments in the form of rivers. The altar is an exact copy of the original one. Above it is the tribune and canopy where the relics were exposed, with a spiral staircase leading up to it; the northern one is ancient, and was found by Alexander Lemoine in the Musée des Petits-Augustins, where for half a century it had been attached to the façade of the château de Gaillon, a sixteenth-century work now in the court of the École des Beaux-Arts. But we are not allowed to think of St. Louis mounting these steps, for they must be placed amongst the additions at the end of the thirteenth century. On one side of the apse is a very beautiful piscina. Part of the baldacchino is the original, and the rest has been restored from old drawings.

Formerly several statues occupied places in the chapel: one a terra-cotta Notre Dame de Pitié, by Germain Pilon, which is now in the chapel of the military school of St. Cyr. A sixteenth-century *jubé*, with altars attached to it, marked the nave from the chancel. The retables of these altars (now in the Louvre) were in enamel, signed and dated Léonard Limousin, 1533, and contain portraits of François I and his second wife, Éléonore d'Autriche, sister of Charles V, and of Henri II and Catherine de Medicis, all kneeling. The choir was filled with carved stalls of the time of Henri II. At the four corners of the altar pavement, Henri III elevated bronze angels upon black marble pillars. On the retro-altar was a silver-gilt model of the chapel, three or four feet high, executed in 1631 by Pijard, *orfévre*, which contained some of the relics. It was considered a very fine work of art and cost 13,000 livres. There is an excellent drawing of the original altar in Viollet-le-Duc's dictionary. Canon Morand tells us, in his history of the chapel, that the ciborium, which is usually placed in the tabernacle, was here suspended in a cross over the altar — probably on the retro-altar, as in the engraving of the high altar in the canon's book there is no representation of it. All the furniture of the church has disappeared.

St. Louis ordained, in his foundation charters, that the offerings received by the priests at the altar should be devoted to the reparation of the glass, and that if it should not be sufficient, the necessary funds should be taken from the Trésor Royal deposited at the Temple. The restoration of the windows is now complete, and was the work of MM. Steinheil and Lusson. These artists have done their work so well, and matched the colors so perfectly, that it is difficult to distinguish the new from the old. The rose-window is of the fifteenth century, the others thirteenth century. The subjects are from the Old and New Testament, and from the life of St. Louis. Some of these latter are original. As it is probable that the artists assisted at these ceremonies, it is also possible that the pictures may be true portraits of the personages represented. The subjects of the rose-window are all taken from the Apocalypse. S. BEALE.

SOCIETIES

BUFFALO SOCIETY OF ARCHITECTS.

AT an adjourned meeting of this society, held October 19, the following officers were elected for the present year: *President*, Cyrus K. Poeter; *First Vice-President*, Geo. J. Metzger; *Second Vice-President*, L. Bethune; *Secretary*, W. W. Carlin; *Treasurer*, R. A. Bethune. Paper for next meeting (November 2) on "When and by Whom was the Arch Invented," by Mr. J. R. Poeter. Question for discussion, "Birch." W. W. CARLIN, *Secretary*.

COMMUNICATIONS

PALLADIO'S FIVE ORDERS.

CHARLESTON, S. C., October 20, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Please inform me in your next issue, or by mail, what price would buy the following work: "*A Short Treatise of the Five Orders*," and other matters, by A. Palladio. London, 1721. Published by John Darby. Plates by John Vantack. Four volumes in two books. I can get the first volume (only one volume) and want some idea of the value of same. An early answer will greatly oblige,

Yours respectfully, E. B. RUTLEDGE.

[B. T. BATSFORD's catalogue quotes the price at 18 shillings and 6 pence. — EDS. AMERICAN ARCHITECT.]

MATERIAL FOR ROUGH-CASTING.

NEW YORK, October 22, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you please inform me through your paper what material is best suited for rough casting with half timber work, the rough cast to be done on brick work; also whether it can be colored in the mass, or painted after being applied.

I am yours truly, E. HADDEN.

[CEMENT, either Rosendale or Portland, is the only material that can be depended upon with any certainty to stay on brickwork. Sawdust mixed with the cement is said to make it hold more firmly. The cement can be colored in the mass with any mineral color not affected by the cement. In our experience, however, the color in the mass seems to encourage a slight efflorescence which injures its effect, and it is necessary to be prepared for a little disappointment. Painting on the surface is easier and neater than the other method, but less durable. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

Ignition by heated Steam-pipes.—With each recurring fall and winter the question of the possibility of fires from steam-pipes becomes one of importance. As the most insidious diseases are usually most to be feared, so the most occult causes of fire are among those which should be most carefully looked after. The apparent paradox of steam —the vapor of water—heating iron to such an extent that it will produce ignition in a contiguous combustible substance, is, of course, hard, perhaps impossible to understand. Had not suspicious circumstances directed inquiry toward this cause, it is likely that the possibility of fires from this source would never have been thought of. The *London Fireman* thinks that the most successful attempt at a reconciliation of the apparent inconsistency of scientific fact with practical experience yet made public is contained in a recent article in *Glaser's Annalen.* The writer, it believes, has arrived at a correct solution of the difficulty. It is very well known that wood, after remaining for some time in contact with steam, hot-air, or hot-water pipes, becomes carbonized on the surface, and to a short distance below. The charcoal, of course, readily oxidizes. When steam is not in the pipes the charcoal will absorb moisture. When again heated the moisture is driven out, leaving a vacuum, into which the fresh-air current, circulating around the pipes, readily penetrates. It imparts oxygen to the charcoal, causes a more rapid rise in the temperature, till finally the point of ignition is reached. The rusting of the pipes, if it occurs, might also conduce to the same result, the rust being reduced by the heat of the steam to a condition in which it will absorb oxygen to the point of red heat.—*The Investigator.*

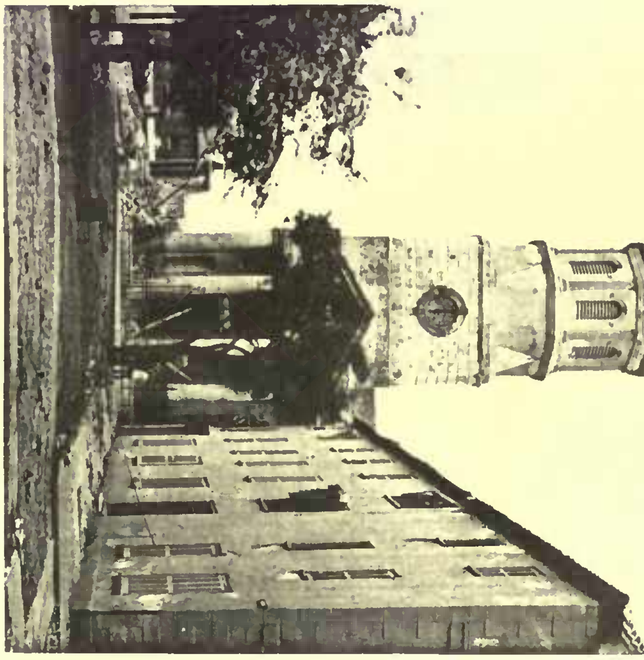
The Origin of Cyclones.—In a recent paper on the "Conservation of Energy in the Atmosphere," Dr. Werner Siemens gives the following theory of the origin of cyclones: The comparative vacuum formed at the centre of a cyclone can produce suction only in the direction of the axis of the cyclone, thus either raising the water upon the surface over which it rotates, or drawing down air from the higher regions of the atmosphere. The existence of such a descending current of air within a tornado is confirmed by the clear sky and quiet air often observed at its centre. We must imagine, says Dr. Siemens, a local cyclone as produced by an impulse of superheated air, due to some local cause or other, given at the boundaries of an upper and lower tract of disturbance of the neutral equilibrium of an atmosphere at rest, which reaches the boundary of the upper cooled strata of air, which have a tendency to descend. We must thus have an outer descending current formed round the ascending one, by means of which as much air descends as has been carried up by the ascending current. If the disturbance of equilibrium embraces extended upper and lower strata of air, the descending masses will produce an increase of pressure in the neighborhood of the cyclone, gradually extending to the surface of the earth, and on the other hand into the highest regions of the air, and transfer its *vis viva* continually into new superheated masses of air which ascend in the cyclone, whilst a part of the descending external cyclone circulating in the same direction, ascends again with the inner, and transfers to it a part of the *vis viva* gained in the higher regions of the air. The course of the centre of the cyclone is then determined by the direction of the mean velocity of all the air masses forming the cyclone, and its duration is that of the disturbance of the neutral equilibrium of the atmosphere which called it forth and maintains it. The local ascending current, by carrying dust and particles with it, may also produce rain by condensing the aqueous vapor of the higher strata.—*Engineering.*

Puddling Clay.—It is stated in the *Aberdeen Free Press* that Mr. Thomas Fraser, of King Street, Aberdeen, has discovered a new method of preparing clay for preventing leakage in reservoirs, water-tanks, etc., and has taken the necessary steps to have his invention patented. Hitherto it has been the general practice, when clay has been used in connection with the construction of water-works, and for other similar purposes, to apply it in a thoroughly wet and plastic condition. From a series of scientifically-conducted experiments, Mr. Fraser has come to the conclusion that far better results can be obtained by drying the clay, and reducing it to a fine powder, before applying it to the bed of a reservoir or to anything which it is desired to render water-tight. A long connection with the brick and tile business led him to study closely the properties of clay, especially when used as a preparation out of which a variety of articles had to be manufactered. He learned from observation that in a wet state clay had reached its extreme point of expansion, and that water would then filter through it. Having ascertained this fact, he concluded that if clay were used for puddling in a dry, compressed state it would absorb a certain percentage of water, expansion naturally following, and rendering the layer water-tight. The greater the pressure of water the more satisfactory the results are said to be. Mr. Fraser began his experiments by selecting his clay from a special bed, out of which he cut a square. The specimen was carefully measured and weighed. After it was thoroughly dried, its dimensions and weight were again taken, when it was found that the clay had lost 25 per cent in weight, while the shrinkage was 10 per cent. Clay in this dry state is extremely hard and compact, and if put into water and not allowed to expand, it would require a long time before water would penetrate to the centre of a 3-inch tube. Another specimen of clay, from the same bed as the former one, was dried and reduced to a fine powder. In this loose condition it absorbed about 75 per cent of the water, which filtered through it. When the clay was prevented from expanding, it was found to absorb 50 per cent of water, which filtered a little. Powdered clay to the depth of 6 inches was pressed into a tube 8 feet long by 3 inches in diameter, and having 2 inches of perforated zinc at the bottom. The tube was then filled with water, with the result that the clay absorbed 35 per cent, but there were no traces of filtration. Mr. Fraser is confident that the method he has hit upon, besides being more efficient, is also more economical in every way than the manner of using puddled clay now in vogue. He is sanguine that it could be beneficially applied in covering arches, in preparing a perfect bed for street causewaying, or, in fact, for the prevention of leakage in any description of work that has to be made waterproof from internal or external pressure.

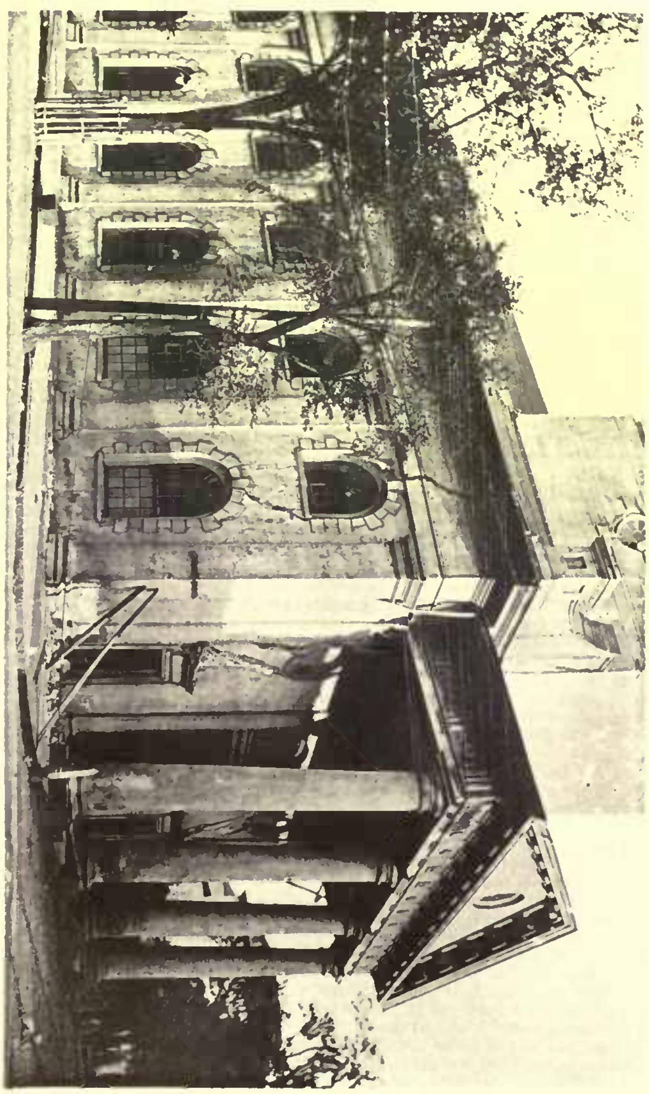
TRADE SURVEYS

The conclusions arrived at by writers of financial business articles in many of our daily papers throughout the country, are that industrial and commercial activity, which set in early in September, will, in all probability, continue throughout the winter. The opinions of the authorities in building interests are to the effect that the winter building perhaps will be more extended than it was last winter. The views of leading railway authorities are that more railway mileage will be built during the next six months than was built during the last season. The views expressed under serial statistics are that we will shortly have an improving trade in spite of the fact that the surplus serial supplies are larger than last year. Their opinion is that with this larger stock prices would improve. They give as a reason that the demand and consumptive requirements are greater this year, and nothing greater than the increased supply to testify their opinion of higher prices. Our leading machinists throughout the New England and Middle States have recently expressed the opinion that the demand in machinery during the next six or twelve months will so far exceed the demand of the past like periods as to allow a very satisfactory increase in the margins on the work. They say, though it looks as if it were mere guess-work, that there will be no labor troubles this winter, and that the improving demand will allow for wider margins. In a few specific cases contracts have been placed for railway, mining and agricultural machinery, and for machinery for textile and rolling mills, which certainly warrant the conclusions above referred to, that prices will be better. As far as organized labor is concerned, the opinions entertained by leading employers, manufacturers, and managers of our large industrial and railroad enterprises are probably correct that there will be a vast amount of preparatory work done in general. The high bidding in machinery building and in railroad work is a fact which is apparent to all those who have given a moderate degree of attention to these matters. The reason for this active activity in preparation is that there is a widespread feeling that prices for material, and prices in many lines of merchandise will probably advance early in the spring. Orders have been given very largely during the past two or three weeks upon this supposition. Contracts have been made for raw material in its various stages to be delivered along through the winter and spring as wanted. Half raw contracts have been placed by iron and steel makers. The largest wool contracts placed for years have been placed upon the cloth manufacturers. In building circles large contracts have been placed for lumber and even for brick. This unusual procedure is based upon two things, first, the fear of advance in prices, and a certain knowledge that the material wanted by this activity, would at other times produce a speculative advance, and is just now producing a very opposite result. The manufacturers, builders, and others are ordering material at current rates in order that they will not be obliged to pay higher prices later on.

Two or three of the highest railroad authorities in the State, no later than this week, say that their instructions to their agents have been to liberally provide for the full requirements; lumber stocks, iron and steel supplies, and rolling-stock requirements, including cars and locomotives. Some of our best-posted builders in New York, Philadelphia and Chicago, well recognizing the strong undercurrents in trade and industries, have declined to assume the risks involved in making contracts, three or four months sooner than necessary. As before stated, however, there are a few exceptions. These observations cover a general trade and industrial situation. To go into details: the European iron-markets are improving. The iron-markets throughout the United States are stronger this week than they have been for three years. Most of the locomotive works are better sold up than they have been for the same periods in past years. Four works are running nine hours per day. As far as our advices go, every properly-equipped car-works in the United States has all the business in hand that can be safely handled. In the coal interest one advance in anthracite has already been made; another will shortly go into effect. The anthracite productions for November are estimated at $3,500,000. In railroad circles we have the past two weeks between seven hundred and eight hundred miles of new road projected concerning the construction of which there is no doubt whatever. They are short lines of road ranging from twenty to sixty miles, several of these lines are in New York, Pennsylvania and Ohio, and there are indications, if statements can be relied upon, that syndicates are about being permitted by which New York and Boston will be benefited in the development of the trans-Atlantic traffic, which will bind the far West and the Dominion in more intermediate commercial relations with those two States. Great railroad improvements are projected by the leading trunk lines in the near West, by which distances will be shortened, and new regions opened up. All these facts go to substantiate the predictions made by railroad managers, that the coming year will be the most active year in railroad construction ever known. The projected constructions are perfectly legitimate and traffic is waiting for it, instead of as formerly building roads, which must wait for the development of traffic. These facts are referred to in order to analyze the opinions of some of our best building authorities, both in the East and the West, and also to understand the logic of some projectors, which has been customary in the formation of syndicates for large manufacturing propositions, particularly in the West. A great deal of Boston and New York capital has united for the purpose of our industrial propositions on a large scale. In the wake of projected railroad construction the lumber trade has been very active during the past week or two. The window-glass manufacturers are endeavoring to form some sort of a national organization for the double object of maintaining prices and securing better control of labor. The hardware interests are still suffering from bids growing from analogies, but in spite of this, more capital has been invested in hardware manufacturing the past year than in former years. Real estate is improving in a few of the larger cities. Building activity is quite active in New York, Philadelphia and Chicago. It is impossible to obtain satisfactory information from many of the smaller cities, but as far as the scattered replies indicate, there will be a greater activity in house and shop building. At present, building labor is in very urgent demand. Labor of all kinds is employed. A serious lockout is threatened in Philadelphia on November 3. Leaders of labor organizations are more active in their efforts to arbitrate and consolidate than are employers in many cases.



ST. PHILIP'S.



ST. MICHAEL'S.



HAYNE ST.

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CONTENTS

THE next Convention of the American Institute of Architects, which will be the twentieth since the foundation of the Institute, is to be held in New York city on the first, second and third days of December next. Messrs. E. T. Littell, A. J. Bloor and O. P. Hatfield have been appointed a Committee of Arrangements, and a detailed programme of the meetings is in course of preparations. Meanwhile the Committee earnestly requests those who will be able to be present at the meetings to notify the Secretary, Mr. Geo. C. Mason, Newport, R. I., as soon as possible, so that provision may be made for their comfort, and it desires also to secure the coöperation of the profession in proposing subjects for discussion, and in preparing papers of professional interest, together with drawings, sketches and models for exhibition at the meetings. New York, being, so to speak, the central point of the United States, has always been a popular place for Conventions of the Institute, and it is to be expected that there will be a full attendance, and as matters affecting the profession, if any action is to be taken upon them, need to be discussed and decided by as large a number of representatives as possible, it is particularly desirable that the vital questions which must very soon be dealt with by architects here, as they already have been abroad, should be placed at the head of the list of subjects to be discussed this year. The Western Association of Architects has done good service to the profession in attacking some of these questions with both zeal and discretion, and, although is is proper enough for the older body to move more slowly, it is time for it to give authoritative expression to the general feeling in favor of a more satisfactory code of professional ethics. So far as its strength as a representative body is concerned, the Institute is better able than ever to secure the respectful attention of the public to its opinions. During the past two or three years its growth in numbers, although quiet, has been very rapid. The limit of seventy Fellows, which was thought not long ago to provide ample margin for the additions of many years, has been far exceeded, and the newer members, we are glad to say, are nearly all residents of the Western States. The element of enthusiasm and enterprise which these new members may be expected to introduce into the deliberations of the Convention cannot fail to be of great value, and it is to be hoped that nothing may prevent a large proportion of them from attending the meetings.

ONE of our correspondents asked the other day for information about the care and preservation of bronze statues, fountains and other decorations, which, as he says, are getting to be much more numerous in this country than they were a few years ago. To tell the truth, a very large part of the fountains and statues in this country, which those who subscribed money to pay for them imagine to be of bronze, are made of cast-iron, colored to imitate the more valuable metal either by means of oil heated on the surface, or by some sort of paint or varnish, while many more are of cast-zinc, disguised in a similar way. Concerning the methods of preserving the patina on works of art of this sort we are unable to give any advice, except to recommend that a judicious house-painter be commissioned to keep watch of the sculptures, and touch them up occasionally, in time to prevent oxidation from getting too firm a hold upon them. With the much rarer objects which are made of real bronze less care is necessary, as there is no danger of their rusting away, but the effect of age and weathering on them is not always so satisfactory as it might be. The so-called antique bronze, which contains nothing but copper and tin, in the proportion of eight parts of the former to two of the latter, acquires by weathering a beautiful green coating, or patina, the production of which may be considerably hastened by oiling the statue occasionally. Modern bronzes, however, are apt to contain zinc, and this impurity prevents the formation of the green patina, and in time produces a disagreeable-looking black rust. Efforts have been made to remedy this in the case of statues made of bad metal, but we think that they have not yet been successful. A great deal might, it would seem, be done in the way of improving real bronze work by architects or other persons of influence. The Japanese and Chinese, for instance, make a bronze of a splendid black color out of eighty parts of copper, ten of lead, four of tin and two of zinc, the remaining four parts in one hundred consisting of iron, nickel, silver, gold and arsenic, perhaps present as impurities in the original ores. This bronze, the beautiful color and texture of which are well known, the Orientals inlay most effectively on a small scale with gold, silver, copper and brass, and there is no reason why the same thing should not be done on a large scale, using, perhaps, instead of gold the gold-colored aluminium bronze, which is not extremely costly, and preserves its brilliancy indefinitely. Mere surface coloring of bronze is easily effected by exposing it to the action of sulphur, or of various metallic sulphides, particularly those of antimony and arsenic, which are applied in solution in ammonia. With these, tints varying from red to steel-blue and black can be obtained, and the colored film is tolerably permanent, although it may in most cases be removed by strong ammonia. Bronzes of this sort, as well as those of zinc, or, as it is often politely called, "white bronze," or of cast-iron, must be cleaned, if they become dirty, with a good deal of circumspection, or the "bronze" will be removed, but articles of real metal, whether covered with patina or not, may be scrubbed with potash, dissolved in water, which removes soot, grease and organic substances without injuring either the metal or its handsome oxidized surface.

LA SEMAINE DES CONSTRUCTEURS, among the other excellent things which it offers to its readers, publishes from time to time what it calls "Consultations Techniques," upon various questions of professional interest. One of these, which appeared recently, was devoted to certain properties of plaster-of-Paris, and in the course of it several observations were made which are of considerable interest to those who use that material. The immediate occasion of the discussion was the experience of one of the subscribers of the journal, an architect in Paris, who was employed to direct some repairs and alterations in a house at Montmartre. The rear wall of the house, as is often the case in Paris, was of half-timber work, consisting of a wooden frame filled in with rubble, and the whole plastered on the outside. In repairing this the old mortar was cleaned off, and a new coat, made, as such coats usually are in the city, of plaster-of-Paris, was put on; and at the same time the new apartments in the building were plastered, and cornices run, in the same material. After waiting two months for the interior work to dry, and four months for the outside work, the plaster was painted. Some six months later, after the work had been finished and approved, the exterior plastering was found to be so porous as to allow rain to beat through it, and to be cracked in all directions, while the interior plastering proved to be so soft that it could be easily scratched away with the nail. The contractors, on being applied to for an explanation of this phenomenon, gave the usual diversity of reasons. One thought that the plaster had been mixed with too much water; another denied this, and said that it was properly mixed, but had been insuffi-

ciently calcined; while a third claimed that the burning and the mixing were well done, but that the stone from which it was originally made was bad. The contractor who did the work maintained that the plaster was of excellent quality, but that the modern plaster, calcined with coal, was inferior to that used by our ancestors, which was calcined with wood; moreover, he claimed that it was well known that an old, half-timbered wall, on being freshly plastered, underwent certain contortions, which tended to crack the new plastering, while the incipient decay which lurked in the ancient timbers infected the plaster and made it grow soft; and as to the interior work, the painter had, he thought, injured the plastering in sand-papering it, after the successive coats of paint, to say nothing of the fact that by finishing the rooms with a gloss, although he saved himself the expense of the flatting coat, he made all irregularities or defects much more visible than they would be in rooms painted in the usual way. These explanations, which will amuse architects, most of whom have listened to long strings of similar ones, seem to have made a certain impression on the owner, who finally compromised with the contractors, by requiring the mason to pay the value of the exterior plastering, which was applied toward the cost of covering it with metallic shingles; while the painter went over the interior work with putty, filling up the cracks and holes, and re-painting. The architect, who did not feel called upon to share in these labors, was dismissed in disgrace, for having been so careless in superintending the work as to allow bad plaster to be used.

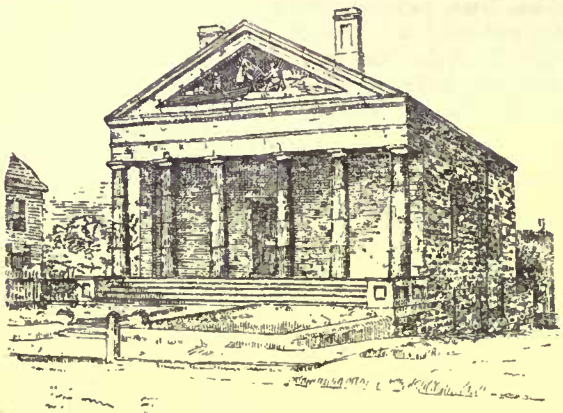
AS it happened, however, instead of neglecting his work, he had been so careful as to test the plaster brought to the building, by taking some of it to his house and mixing it with water, which, in his hands, gave an excellent mortar. Unable, therefore, to understand the real cause of the softening of the work at the building, he applied to *La Semaine* for an explanation more satisfactory than any of those advanced by the contractors. M. Detain, who seems to direct this portion of the journal, furnished him with this by observing that the change in the condition of the plastering seemed to be rather the result of using it too fresh than of any defect in the burning or in the quality of the original stone. According to him, the ancient practice, by which the calcined gypsum rock was laboriously pounded to powder at the kiln, is now superseded by much more rapid processes, so that the rock, often calcined, to save time, at a high heat, is taken from the kiln and thrown, while still hot, into a mill, from which it issues, still warm, in powder ready for use, which is packed in bags, and often sold and delivered at the place where it is to be used before it has quite lost the heat of the kiln. When plaster as fresh as this is mixed with water, it sets with great energy, and with the evolution of much heat, but on cooling and drying the mass shrinks, softens, cracks in all directions, and becomes weak and disposed to crumble. To guard against this effect, which is as serious with good plaster as with bad, it is necessary to make sure that the material is properly cooled, leaving it, if there is any doubt on the subject, exposed to the air for several days before using. Unfortunately in small establishments there is often no room to store the plaster, and it must be thrown into the mixing-pen as soon as it arrives at the building, for want of any other place to put it; so that the safest course is to make sure that it has been kept on hand for several days or weeks at the manufactory.

THE *Builder* gives an account of a paper read before the British Association last month, by Mr. Conrad W. Cook, describing a method for increasing the brilliancy of gas-lights by placing in them a solid mass of some refractory substance, which shines by incandescence. For some time a light of the kind has been produced by means of cylinders of magnesia, which are placed near a gas-jet, and the gas first lighted and then, when the cylinders have become hot, turned off, and then turned on without re-lighting. Under these conditions the gas, striking the incandescent magnesia, burns in its pores without smoke, but with an intense heat, raising the magnesia to a dazzling brilliancy, the light emitted from it being much greater than would be produced by the same amount of gas burning with a flame. The magnesia cylinders, however, seem to be rather unsatisfactory, and various substitutes have been proposed for them. One of these, which was described by Mr. Cook, has been patented by Dr. Carl Auer von Welsbach, of Vienna, and consists in the ash of cotton cloth, saturated with solutions of alkaline earths. The cloth is made into a hollow cylinder, and soaked in a liquid composed of solutions of zirconia and oxide of lanthenum, and, after drying, is burned. The organic portion is immediately destroyed, but the earthy ash retains its form, and, being very porous and incombustible, answers admirably as the refractory source of the light of incandescence. The cylinders are used just like the magnesia cylinders of the earlier lamps, and the light from them is said to be from two to three times as great as would be obtained by burning the same quantity of gas with a flame, while the cylinders last from eight hundred to one thousand hours in good condition for use. If the experiment has not been already made, we would suggest the trial for this purpose of cylinders made of magnesia and sawdust, after the method employed in manufacturing the porous terra-cotta so common with us. By varying the proportion and degree of fineness of the sawdust, almost any texture and amount of porosity might be obtained in the calcined cylinders, at the smallest possible expense, and, if desirable, lime, alumina or any other earth of difficult fusibility might be substituted for the magnesia.

THE *Revue Industrielle* describes and illustrates a simple machine for making "wood wool," or, as we should call it, "excelsior," out of chips and refuse pieces of wood. The use of this sort of fibre, for filling mattresses, for bedding animals, for filtering liquids, and for packing, is now so universal that there is a constant demand for it, and the refuse pieces which encumber wood-working shops can be made into wool, and sold at a profit over the cost, while the usual mode of disposal, which consists in burning the chips under the boiler, simply gets rid of them by allowing them to replace about one-fifth their value of coal. The new machine, which promises to effect an important economy in wood-working shops, particularly in those where furniture is manufactured and packed, is provided with rollers, by which bits of any size or shape are seized and pushed under a plane, which takes off a shaving of a thickness regulated by a set-screw. This shaving, continuing its course, is then brought into contact with a row of blades, which divide it into filaments, of a width easily regulated, while the original block returns to the starting-point to be shaved again by the plane. With a single-acting machine a thousand pounds of fibre can be cut in a day, and the product can be nearly doubled, with little increased expenditure of power, by arranging the machine with a double-acting set of planes. At present prices in France the material can be produced at a cost of four-tenths of a cent per pound, and sells readily at one cent a pound or more, according to the market. It does not appear whether the American fashion of using the wood fibre instead of hair in plastering mortar has yet been introduced in Europe, but with us a large amount would probably be consumed in this way, and a good deal more might with advantage be used for oiling and rubbing, in place of cotton waste, which costs ten times as much, and is said to be no better.

THE *Sanitary Engineer* reports perhaps the worst case of ignorant specifying for plumber's work that has ever been recorded. According to a correspondent who writes from Nebraska, and signs himself "Plumber," the architect of a certain public building erected in Kansas not long ago ordered, in his specification for the building, that all the waste pipes from the different fixtures in the building, including water-closets, urinals and wash-basins, should be carried to the basement and entered into a sewer-pipe, which should be laid in the basement to receive them, and should "conduct same to cistern outside of building." The same sewer-pipe was also required to be prepared to receive rain-water from the roof, and another clause in the specification provided that a tank, for furnishing water to the house, should be built in the upper story, and "supplied with water from the above-mentioned cistern." The *Sanitary Engineer* very properly remarks that "in all probability the so-called architect who was responsible for this stupidly dangerous specification is no more entitled to be considered an architect than many men who pretend to do plumbing work are entitled to be considered plumbers," but we do not see how this circumstance affects the conclusions to be drawn from the story as to the care with which the selection of architects for public buildings is made in Kansas.

EARLY SETTLER MEMORIALS.[1]—III.

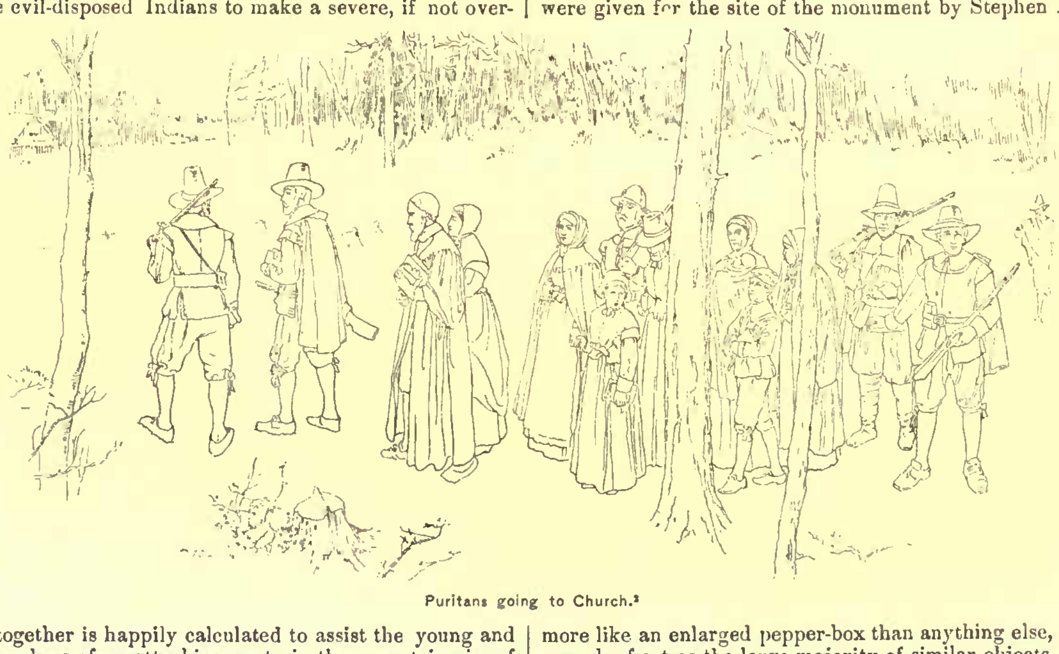


Pilgrim Hall, Plymouth, Mass.

PURITANS GOING TO CHURCH.

THE most popularly attractive illustration of the danger of Indian attacks in early settler life in America, is George Boughton's picture of "Puritans Going to Church." The picture does not depend entirely upon its name for an explanation of its meaning. At the first glance, the intention of the artist is understood, and the impression the picture is made to produce, is at once felt by the observer — and the first glance is about the extent of attention or study that is given to works of this kind. The sympathy is awakened, and the mind trusts to history for a confirmation of the true value of the picture as a delineation, and of its merits as a logical representation of the subject.

A slight analysis of this picture is sufficient to show that the artist considered the elements of danger, and the means of defense, if he did not arrange them in a perfectly harmonious proportion. The woods and underbrush in the near background afford an ample hiding-place for the evil-disposed Indians to make a severe, if not overwhelming attack upon the devotional procession, and from a point from which the innocent Puritans are evidently not expecting one. It is rather from the spectator that danger is apprehended, as the only indication of expected surprise, mild though it be, is seen in the faces of two men and the girl, all three looking out of the picture. The grouping of the figures so closely together is happily calculated to assist the young and inexperienced members of an attacking party in the uncertain aim of their arrows.



Puritans going to Church.[2]

The elements of danger, so far as good accommodations for the Indians are concerned, are perfect in this picture. They are, in fact, unquestionably, too perfect, for there is not the shadow of a savage to be seen anywhere. The absence of "the Indian foe," also serves a double purpose. It shows that the object of the picture is attained by the use of accessories, while the vital reason of its existence remains in the dusky seclusion of his wigwam. It is a clear case of picturesque delusion; of aggravated emotional results produced by partially non-existent causes. And yet there is a reason for this that we shall discover as we go along, for it will be remembered that this picture is entitled, "Puritans Going to Church," yet not a soul of these fourteen forlorn and self-abnegating creatures budges an inch. Every one of the fourteen feet that are visible, are as immovably fixed upon the surface of the snow, as though frozen by the heartless rigors of a New England winter. And the bodies are also stationary, none has ever moved, nor will ever move. There they are set up like so many manikins, to scare away the savages.

The extreme care with which each foot is painted, the absence of foot-marks on the snow, the uncovered hands and warmly-clothed bodies, the dreary and well-painted wintry landscape, excite sympathy for these unfortunates, who turn a good piece of painting into a wax-figure show.

[1] Continued from page 156, No. 562.

[2] By the courtesy of Messrs. Knoedler & Co. we are allowed to reproduce Boughton's picture in outline.

STANDISH MEMORIAL.[3]

The Standish monument at Duxbury, Mass., seems to have been completely forgotten, even by those who were formerly connected with it, for it was only after repeated inquiries that the writer could find out anything about it. It is probably the most unfortunate monument scheme ever undertaken in the United States, with the exception of that to the memory of the Father of his Country, at Washington, D. C.

"The Standish Memorial Association," including in its membership a large number of the foremost citizens of New England, was formed at Duxbury, Mass., December 21, 1870. Its object was the erection of "a suitable and proper memorial monument, obelisk, or tablet, to the memory of Captain Miles Standish, on or near Captain's Hill, Duxbury, Massachusetts."

The spot finally chosen for the monument was Captain's Hill, an elevation within the limits of the old Standish farm in Duxbury, where the Captain lived, died, and is believed to have been buried. "The farm was given him by the Colony about 1630, and remained in the family until the middle of the last century. The hill is one hundred and eighty feet high, and overlooks Plymouth and Duxbury bays, and is now much used as a sighting point by navigators entering Massachusetts Bay. When the shaft is up, it will be most useful to the coast survey, as well as to navigators."

The height of the monument was intended to be one hundred and fifty feet, including "a probable statue in bronze, of the Captain, twelve feet high, which will be a truthful likeness." The octagonal base, twenty feet in diameter, rises to the height of twenty feet, thence to the top "it will be perfectly round." The whole structure was "to be built of irregular rough granite blocks, and plastered on the inside." The top of the monument was to be reached by a stairway running around between the inside the monument and outside of a "brick cone" that extended from the base to the summit in the centre. The contemplated cost of the completed structure was estimated to be from $50,000 to $80,000.

Work on the monument ceased in 1874, leaving it in its present condition, at the height of seventy feet. About $23,000 have thus far been expended. It is "expected that next year will see it rise to the height of one hundred feet. Five acres on the top of the hill were given for the site of the monument by Stephen M. Allen, Esq., of Duxbury. The ground was consecrated to its intended purpose on the 17th of August, 1871, and the corner-stone was laid on the 7th of October, 1872. The design was furnished by Mr. Alden Frink, a Boston architect.

These are all the facts, usefully dry, that we have been able to gather concerning the Pilgrim Captain's Memorial.

The design, though looking more like an enlarged pepper-box than anything else, is quite as much a work of art as the large majority of similar objects. It is really an unfinished empty pepper-box, whose historic, intellectual and artistic value is fully illustrated on one of the keystones of the arch of the doorway, where the abbreviation of the name of a New England State is engraved thus — M. E.

It should be added that the projectors of this enterprise made no mention of an intention to erect either a work of art, or "the greatest monument in the world."

PILGRIM HALL, PLYMOUTH,

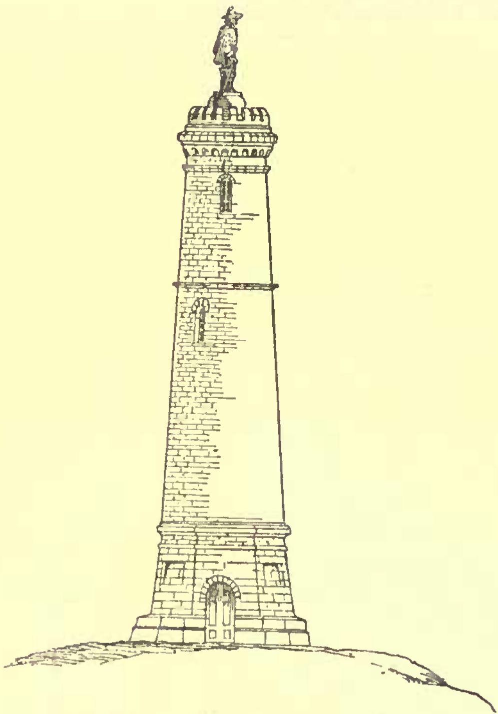
was erected by the Pilgrim Society, in 1824, as a monumental hall to the memory of the Pilgrims. It contains memorials of the Pilgrims, and the town library.

"The iron railing in front of the Hall, enclosing a part of the 'Plymouth Rock,' has inscribed upon it the names of those who signed the ever-memorable Compact on board the Mayflower, in Cape Cod harbor.

"In the year 1775, the people of Plymouth, to render available the

[3] A meeting of the Standish Monument Association was held Wednesday, at the room of the Webster Historical Society, Old South. It was voted to go on with the erection of the monument on Captain's Hill, Duxbury, so that, if possible, it may be finished in 1887, the two hundred and fiftieth anniversary of the charter of the town. It is now seventy-two-and-a-half feet high, and it is to be carried up to one hundred and ten feet besides the statue. One gentleman has offered to contribute $1,000 toward the finishing. It will be one of the largest private memorial statues in the United States, and has cost so far $25,000. — *Boston Advertiser*, July 30.

patriotic associations connected with the rock, undertook its removal to the town square, with the intention of placing over it a liberty pole, as an incitement to vigorous efforts in the approaching revolutionary struggle, and to quicken the zeal of such persons as hesitated to join the standard of independence. In this attempt at the removal, the rock split asunder, to the great surprise of the people present;



The Miles Standish Monument, Duxbury, Mass.

and by some it was construed into a favorable omen, indicating the final separation of the colony from the mother country. This unexpected incident led to some hesitation among the excited group assembled, and the conclusion was to leave the lower part of the rock in its original bed, and remove the other part to the town square, where the far-famed liberty pole was speedily erected over it, on which an appropriate poetic effusion of some ardent son of liberty was placed, urging the citizens to renewed effort in the cause of their country."

It remained at the foot of the liberty pole until 1834, when it was removed to its present resting-place.

CANOPY OVER PLYMOUTH ROCK.

The memorial canopy over the "Rock" upon which the forefathers landed is thirty feet high and fifteen square, and built of granite. "It is surmounted by a scallop shell, indicative of the Pilgrim character of the enterprise of the Fathers." In the chamber formed by the upper part of the structure are deposited the remains of some of the pilgrims who died the first year after the landing.

CUSHMAN MONUMENT.

This monument was erected by the descendants of Robert Cushman, a fellow-exile with the pilgrims in Holland, afterwards their chief agent in England, and finally a resident of Plymouth from 1621, until his death in 1625. It was consecrated July 16, 1858, to the memory of Robert, and his son, Thomas Cushman, who was "ruling elder of the first church in Plymouth for more than forty-two years." It is made of Quincy granite and is twenty-six feet high. It stands on the spot where Elder Cushman was buried in 1691.

The original tablet, of slate, placed at the head of his grave in 1715, was brought from England, and is now deposited in the museum of the Plymouth Society of Plymouth. It bears the following record:

HERE LYETH BURIED Y^e BODY
OF THAT PRECIOUS SERVANT OF
GOD M^r THOMAS CUSHMAN, WHO
AFTER HE HAD SERVED HIS
GENERATION ACCORDING TO
THE WILL OF GOD, AND
PARTICULARLY THE CHURCH OF
PLYMOUTH FOR MANY YEARS IN
THE OFFICE OF RULING ELDER,
FELL ASLEEP IN JESUS DECEM^r.
Y^e 10, 1691, & IN Y^e
84 YEAR OF HIS AGE.

BURYING HILL, PLYMOUTH.

"On the brow of one of the highest eminences in the old town of Plymouth," says Dr. Shurtleff, "rest the mortal parts of many of the Pilgrim Forefathers — too many of them, alas! without even a humble gravestone to mark the spot of their sepulture. The turf, in gently-rising mounds, indicates what tradition alone besides, in the absence of all written testimony, makes more certain, that there the fathers are sleeping from their labors.

"When the modern pilgrim finds his way to Plymouth, and, with filial veneration, directs his step to the sacred spot where rest the fathers of New England, he is peculiarly struck with the remarkable objects which are presented to his view. When he has ascended the high hill, and looks around upon the innumerable gravestones which affection has placed as the last tribute to the memory of departed parents, relatives and friends, he seeks in vain for an ancient memorial to mark the graves of the '*Mayflower*' Pilgrims of 1620. In vain he inquires for the graves of those who came in the '*Fortune*' in 1621, in vain for those of the '*Ann*' and '*Little James*' in 1623. In vain he asks, in vain he seeks. Of all these, Thomas Cushman alone of the '*Fortune*' and Thomas Clark alone of the '*Ann*' are remembered by tablets. Their graves alone were surely designated by gravestones on Burying Hill. One of the old comers, Phineas Pratt, was similarly remembered in the old burial-ground in Charlestown. Uncertain tradition, however, has attempted to point out the burial-places of a few others, and modern memorials have been erected to their memory.

"In an elevated position in one part of this field of the dead may be seen the shaft erected in memory of William Bradford, not only emphatically the governor of the Plymouth colony, but the faithful chronicler of the Pilgrims, his associates in the great enterprise. In another direction is the large slab commemorating the life and services of the venerable John Howland; and still, in another portion of the field, the monument which the filial regard of the Cushman family has raised over the grave of their pious ancestor, the excellent Elder. These, indeed, are modern erections, but not the less honorable. . . .

"Close beside the green hillock subsequently selected as the grave-lot of the venerable Elder, the fathers, in earlier days, built their humble sanctuary — small, indeed, but then the only one in New England, and that one their own, and untrammeled by the yoke of anti-Christian bondage. . . .

"Here, still earlier, stood the scanty fortification of the peaceful little band of Puritans — a simple platform, with slender roof and unpretending battlements, hewn from native forests. Slight as was the structure, it served well to protect them from the sudden inroads of savage beasts, and as a defence against the hostile attacks of the more wily and barbarous Indian foe. It served another and a holier purpose — it was the place of prayer, the place of worship — the first rudiments of the first building of the first church of the Pilgrim Fathers.

"While standing within this ancient cemetery, the stranger is forcibly struck with the appearance of the large number of monumental tablets and burial-mounds which he notices on all sides, compared with the smaller number of buildings in the village at its base — that the dwellings of the dead far outnumber the dwellings of the living. The immediate scene presents a vast assemblage of the past and a more limited population of the present — the quiet remains of other days above, and busy and bustling life of to-day below. Here is where the forefathers lie with their children of more than two centuries, gathered together in family clusters, awaiting the call of the last great day. And where could they lie more appropriately than in the chosen land of their American pilgrimage?"

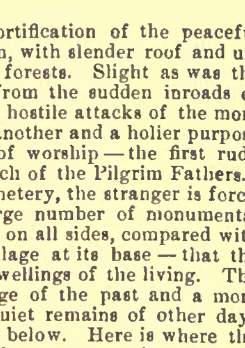
BRADFORD MONUMENT.

The marble obelisk in memory of Gov. William Bradford, the second governor of the colony, with its untranslatable Hebrew text, and its Latin inscription: "Do not basely relinquish what the Fathers with difficulty attained," was erected in 1825. The oldest stone on Burying Hill is that to the memory of Edward Gray (1681), one of the wealthiest men of the colony.

John Howland's grave-stone bears the following inscription:

"Here ended the pilgrimage of JOHN HOWLAND and ELIZABETH, his wife. She was the daughter of Gov. Carver. They arrived in the Mayflower Dec., 1620. They had 4 sons and 6 daughters, from whom are descended a numerous posterity.

"1672, Feb. 23d. JOHN HOWLAND, of Plymouth, deceased. He lived to the age of 80 years. He was the last man that was left of those that came over in the ship called the Mayflower, that lived in Plymouth."



Marble Monument to Wm. Bradford, Second Governor of Plymouth Colony, Plymouth, Mass.

PLYMOUTH MONUMENT.

In an article published in this journal in July 1881, under the title of "Civic Monuments in New England," we spoke at length of the above structure. Since then a granite object, called by the ennobling name of "Education," and a bas-relief in marble, entitled, "Signing of the Social Compact in the Cabin of the May-flower," have been added to it. They were the gifts of Roland Mather, Esquire, of Hartford, Conn. As in previous descriptions of this terrible pile of granite by those who caused its erection, so in the description of the statue of Education, the amount of material and the weight thereof, have been duly emphasized as the proper recommendations to respect for it as a commendable work. As an interesting and significant item in the history of this monument, and as a just illustration of its relation to art and the kind of intelligence that has been directly and successfully engaged in its erection, we give below a copy of an advertisement that is published on the back of a photograph of the upper part of the Statue of Faith:

"STATUE OF FAITH, FOR PLYMOUTH MONUMENT.

"The Statue of Faith, a part of which is here shown, crowns the

National Monument, being erected at Plymouth in honor of the Pilgrims. This statue is thirty-six feet high, and comprises the cubic contents of two hundred and sixteen life-size statues. It rests upon an octagon pedestal forty-five feet high, thus making the monument one of the grandest and most imposing of its kind in the world. She stands with her foot upon a portion of 'Plymouth Rock'; in her left hand she holds an open bible; with the right uplifted she points to heaven. Looking downward, as to those she is addressing, she seems to call them to trust in a higher power.

"The figure is the work of the Hallowell Granite Company, Hallowell, Maine, from their celebrated white granite. The work of quarrying the stone was begun in June, 1876.

"The blocks of granite of which it is composed, when taken from the quarry weighed more than four hundred tons. In its finished condition it is estimated to weigh two hundred tons. The process of making the figure, in which the skill of the most gifted sculptor was necessary, was one of great difficulty. The contract for cutting it was let to Joseph Archie, a Spaniard, who is probably one of the most skilful carvers and sculptors in the land. The time occupied in the execution of the work was one year, it being completed July 10, 1877. The upper portion of the figure was on exhibition at the yards of the Company for four days, and was visited by many thousands of people.

"Every person contributing $1 to the Monument Fund will receive this photograph and a steel engraving of the entire monument, including a view of Plymouth from the bay.

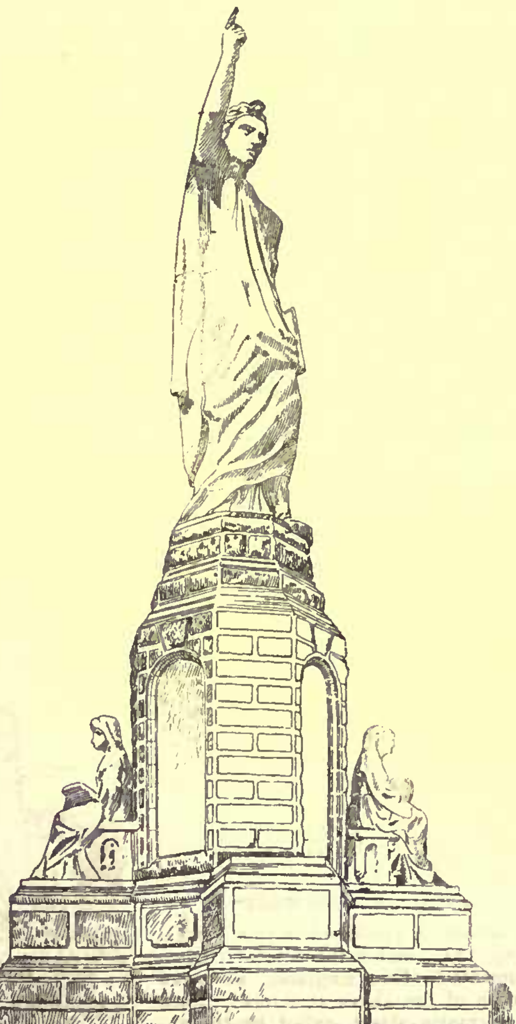
"Communications should be addressed to Rev. W. M. Harding, General and Financial Agent, 3 Tremont Row, Boston, Mass.

"Copyright 1877, by W. M. HARDING."

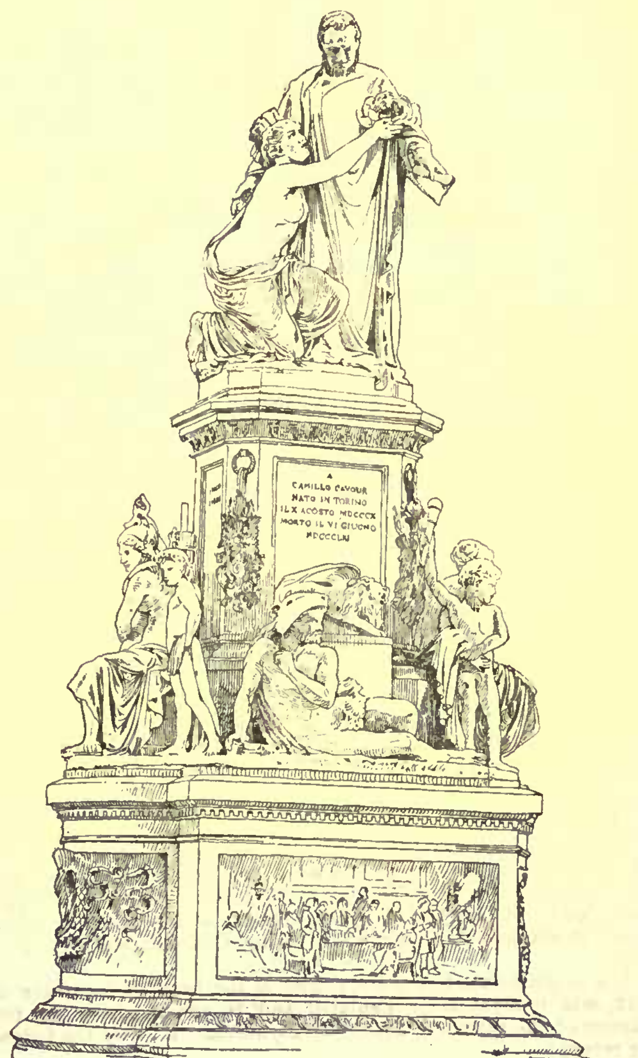
its present condition, the enormous increase of public preference for size and weight, as the all-sufficient qualities in the construction of monuments, the total indifference to the principles and facts of art, that characterize the great monuments of the world, the complete absence of respect or care for what really makes a monument, there seems to be no reason why this one will not be completed in due time, in accordance with its great character.

When it is remembered that the great monuments of the world were made by artists who were as eminent in their professions, and as great as men, as those who were concerned in the events which those structures commemorate; and as great as the statesmen, orators and poets who celebrate those events, it might seem to the critical observer that the granite-cutters who hewed out the National Monument to the Forefathers would not bear a satisfactory comparison. Between the artists who made the monument lately erected in Florence, in commemoration of Count Cavour, and those who made the Plymouth monument, there would seem to be something of a disparity. Those who made the former are known in France as men eminent in their professions; while the names of the authors of the latter are buried beyond mention under the hundreds of tons of merciless stone, by the enthusiastic care of a financial agent.

If the curious student of art and history should, on beholding this monument, and especially the view of "Faith" given in the illustration, call to mind the great Americans who have spoken, written and sung the fame and reverential remembrance of the Pilgrim Fathers, from 1820, when Daniel Webster spoke, to the present day, he might



National Monument to the Forefathers, Plymouth, Mass.



For additional particulars concerning the size of this figure we copy from the back of a photograph showing the present condition of the monument. "The outstretched arm measures, from the shoulder to the elbow, ten feet, one and one-half inches; and from the elbow to the tip of the uplifted finger, nine feet nine inches. The head measures around, at the forehead, thirteen feet seven inches; from under the chin to the top of the head is fourteen feet, five inches. The points of the star upon the forehead are just one foot across. The length of the finger pointing upwards is two feet, one inch, and it measures one foot, eight and one-half inches around. The length of the nose is one foot, four inches."

It is estimated that $100,000 have been thus far expended on the monument. The statues of "Law" and "Freedom," with their accompanying bas-reliefs of "The Landing at Plymouth" and "The first Treaty with the Indians," are yet to be executed.

Judging from the persistent energy displayed in completing it to say that, if this structure was an expression of American genius to be compared to those uttered by statesmen, orators and poets, there would need to be some additional recommendation of its merits beside the unlettered encomiums of a rustic photograph-vender and the startling announcement of the length of a nose. He might also ask if those men who have caused its erection were not amenable to a higher and more exacting tribunal than the impressive precincts of the Hallowell granite yard.

The Plymouth monument represents the most reprehensible methods that can be employed in such enterprises. "The practices and the productions of our sculptors, working at home or in Italy," are not more reprehensible, though some of them are undoubtedly more cunning and more adroitly conducted. The architects and workmen who have been connected with this monument are already forgotten, but it will stand for centuries as an expression of the taste and intelligence of the men who have been active in its construction. It has

received the sanction and approval of the most eminent citizens of the country. It will be regarded as their work and that of no others. Fortunately its situation is such that it will never be brought into critical comparison with the large monuments of the world that are known as works of art, and the American people will be spared the mortification that would then result.

It is interesting to read what was said at the time this monument was projected. The Hon. Richard Warren concluded his address, on the occasion of laying the corner-stone, with the assertion that "We are now about to lay the corner-stone of a structure grander than any of the kind the world has ever witnessed. . . ."

The Pilgrim almanac of 1860 says, in an article on the proposed monument, that "History will look in vain for a greater event to chronicle; art will never again for us have the opportunity or the occasion to embody themes so simply grand, so peculiarly significant. It is worthy, then, of all that art can offer as a testimony."

Hammatt Billings, the designer of the monument, wrote as follows: "The National Monument to the Forefathers, which is just about to be commenced under the auspices of the Pilgrim Society, is intended to be the grandest work of the kind in the world. Raised in commemoration of the great starting-point in our history, it is the idea to make it, as far as possible, worthy of the great event which it will record. In size it will be the greatest of modern works, and only equalled by those vast monuments of Egyptian power and grandeur which remain to us, the most wonderful triumphs of mere mechanical skill."

The difference between the proportions and general effect of the original design and the above enthusiastic words are not so unpleasant as that shown in the comparison of the original design with the present structure. Thomas Clark's gravestone has more art in it and is more interesting to the artist, than the great monument.

THE ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

THE CONVERSE MEMORIAL LIBRARY, MALDEN, MASS. MR. H. H. RICHARDSON, ARCHITECT.

[Gelatine Print issued only with the Imperial Edition.]

INTERIOR OF THE SAME.

[Gelatine Print, issued only with the Imperial Edition.]

STABLE FOR MR. H. G. HARWOOD, ESQ., NATICK, MASS. MR. W. FRANK HURD, ARCHITECT, BOSTON, MASS.

THIS stable, which will be completed this fall, is being built by day-work. It has Milford granite, split underpinning, and best pressed-brick, vaulted wall up to the Longmeadow stone belt under first-story windows. The second floor has mill framing, and the moulded panels between floor-timbers have hard-pine sheathing; also the walls above the brickwork. The stall portion and the driveway of carriage-room will have paving of pressed bricks on edge.

COMPETITIVE DESIGN FOR A $5,000-HOUSE, SUBMITTED BY "*Lawn Tennis.*"

MASONRY.	
Preliminary,	$15 00
Excavation,	34 50
Footings,	20 00
Foundations,	219 15
Underpinning,	56 40
Hatchway or area,	17 20
Piers and partitions,	3 60
Chimneys, mantels and grates,	321 60
Lathing and plastering,	339 90
Cellar bottom,	55 44
Drains,	15 00
Cistern, catch-basin and cesspool,	20 00
Miscellaneous,	10 00
Total of masonry,	$1,127 79
CARPENTRY.	
Frame,	463 87
Frame covering,	468 67
Roof,	240 14
Cornice,	54 48
Cellar hatchway,	14 34
Windows,	412 08
Dormer windows,	$15 00
Veranda,	163 10
Floors,	369 32
Closets and store-room,	41 76
Doors,	451 86
Stairs,	156 00
Wainscoting and base,	71 31
Pantry and butler's pantry,	20 36
Kitchen sink, etc.,	13 64
Bath-room,	52 20
Mantels,	180 00
Book-cases,	48 00
Washstand and slop-sink,	13 10
Dressers,	19 20
Cold-air duct,	16 82
Coal-bins and partitions in cellar,	21 48
Miscellaneous,	25 20
Painting,	342 00
Heating, tinning, slating and galvanized ironwork,	276 00
Plumbing and gas-fitting,	186 50
Total for house,	$5,264 22

HOUSE FOR P. S. KINSEY, ESQ., NEWARK, N. J. MR. CHARLES EDWARDS, ARCHITECT, PATERSON, N. J.

HOUSE AT WAVE-COAST PARK, FAR ROCKAWAY, L. I., FOR E. H. HARRIMAN, ESQ. MR. W. GIBSON, ARCHITECT, ALBANY, N. Y.

UNION PASSENGER RAILWAY STATION, OGDEN, UTAH. MESSRS. VAN BRUNT & HOWE, ARCHITECTS, BOSTON, MASS.

AMERICAN ARCHITECT COMPETITION FOR HOUSE COSTING $5,000.[1] — X.

THE eight following designs have all worse plans than any of the others, and although the exterior may be somewhat better than some of the preceding, these have been placed near the end of the list on account of extremely poor planning.

"*Dan.*" — Dining-room inconvenient. No direct way of getting to front door from kitchen. Too many chimneys. Waste room in passages. Exterior: too high-shouldered; details of architect's vernacular of ten years ago and carpenter's vernacular of to-day — hard and stiff, without good outline or proportion. Rendering somewhat stiff, but clear, direct and good.

"*Black and White.*" — Nursery should not be on first story nor near living rooms. Details thin and poor. Truncated gables are always bad. Otherwise, house is simple, but common-place.

"*Romantic.*" — Servants obliged to pass through sitting-room to get to front door. Library badly placed. No provisions for nursery or novelist. No details except on perspective, where there are too many, all of which are designed with no idea of scale, purpose or outline. Rendering poor. Stones look woolly, shadows are scratchy and foliage very bad. Design has no sense of simplicity of treatment or of anything except a desire to string together a lot of would-be picturesque units.

"*Don Quixote.* — To make library and study open through dining-room and parlor is not good planning, nor is a long, narrow corridor in second story. No constructive details; other details heavy, except staircase, which is better, but thin. Exterior badly roofed. No dominating roof. Dormer very bad in form. Rendering hard and stiff.

"*Nota Bene.*" — A nursery next to dining-room and entered through it is a peculiar but not praiseworthy feature. Details bad; no proportions or sense of line. Exterior spotty; needs concentration of motives. Rendering unskilful.

"*A. T.*" — Basement kitchen calls for extra servant. To have children's room next to dining-room is not desirable. Dining-room is reached only through sitting-room, and servant has to come up stairs and pass through two rooms to reach front door. Details stiff. General masses and scheme of exterior very good, but badly carried out. Lacks proportion of eaves and mouldings. House could have more than one chimney with advantage.

"*Long Mow.*" — Staircase arrangement is very poor. No head-room for cellar-stairs, if rooms in first story are on a level, as they seem to be, and, in fact, the staircases are in a perfect snarl and are very dark. Much waste room in centre of house. Exterior simple and uninteresting. Rendering scratchy and unskilful.

"*Eureka.*" — No provision for novelist. Staircase ineffective. Upper hall dark. Details very poor. Exterior is a collection of unrelated parts. No sense of mass, proportion, light and shade, surface or detail. Rendering very poor and weak — evidently the work of a very new hand.

"*Tobacco.*" — No bedroom should open from a dining-room. Details drawn to unnecessarily large scale and are bad throughout. Design is roofed well, but otherwise is the work of one who needs a great deal of study, and is of that perfectly innocently-ignorant class of work that defies criticism. To this class also belongs "*Home A,*" and the design with the long Latin motto, "*Hall Faciemtur,*" etc.

SAFE BUILDING.[1]—IX.

GRAPHICAL METHOD OF CALCULATING STRAINS. — NOTATION.

Notation. THE calculation of strains in trusses and arches is based on the law known as the "Parallelogram of Forces." Before going into same it will be necessary to explain the notation used.

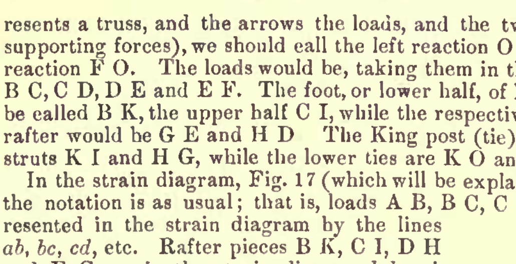


Fig. 16.

If Fig. 16 represents a truss, and the arrows the loads, and the two reactions (or supporting forces), we should call the left reaction O A and the right reaction F O. The loads would be, taking them in their order, A B, B C, C D, D E and E F. The foot, or lower half, of left rafter would be called B K, the upper half C I, while the respective parts of right rafter would be G E and H D The King post (tie) is I H, and the struts K I and H G, while the lower ties are K O and O G.

In the strain diagram, Fig. 17 (which will be explained presently), the notation is as usual; that is, loads A B, B C, C D, etc., are represented in the strain diagram by the lines *ab*, *bc*, *cd*, etc. Rafter pieces B K, C I, D H and E G are in the strain diagram *b k*, *c i*, *d h* and *e g* (*g* and *k* falling on the same point). I H in Fig 16 becomes *i h* in strain diagram. K I becomes *k i*, H G becomes *h g*, O K becomes *o k*, G O becomes *g o*, O A becomes *o a* and F O becomes *f o*.

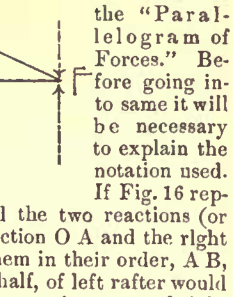
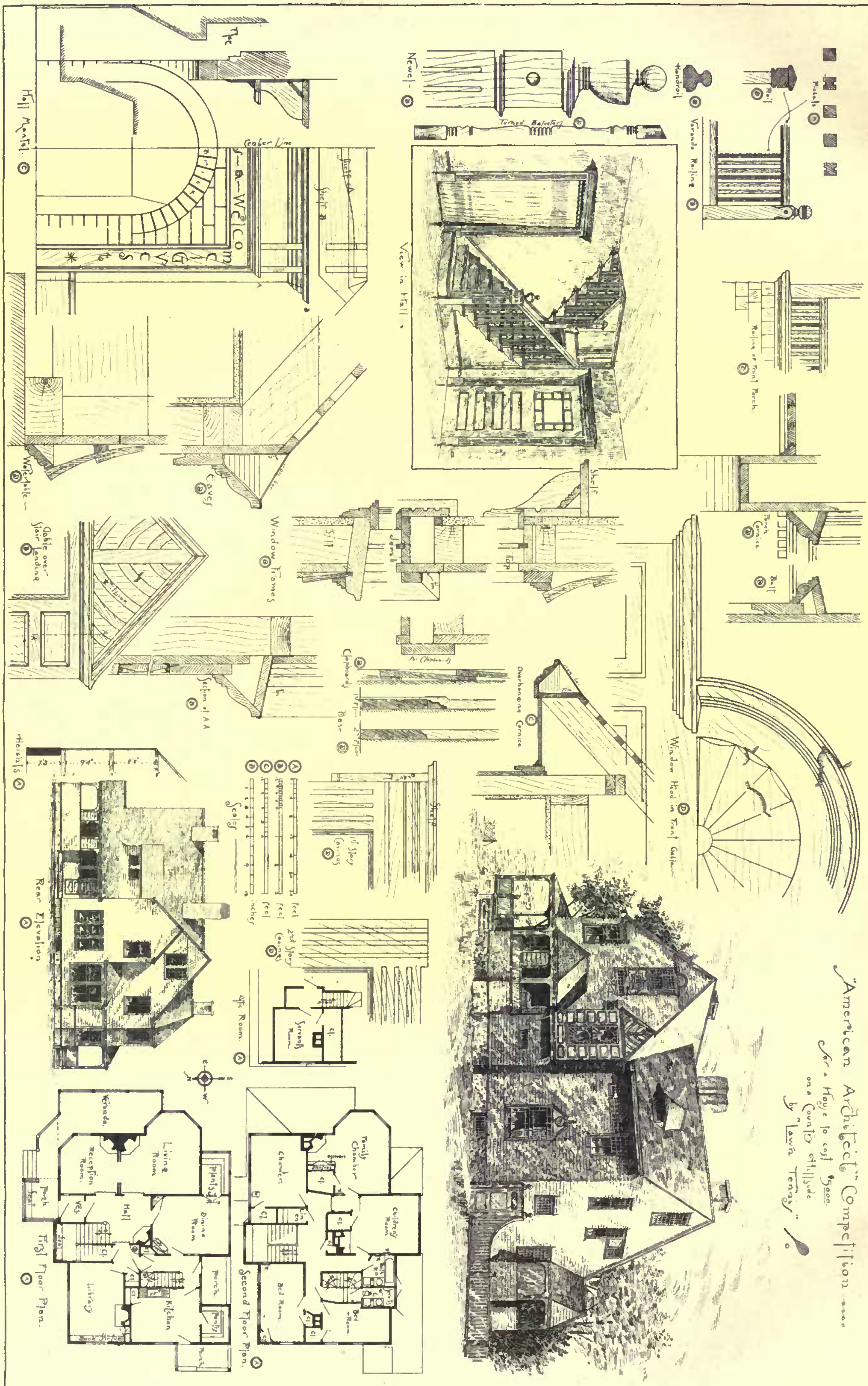


Fig. 17.

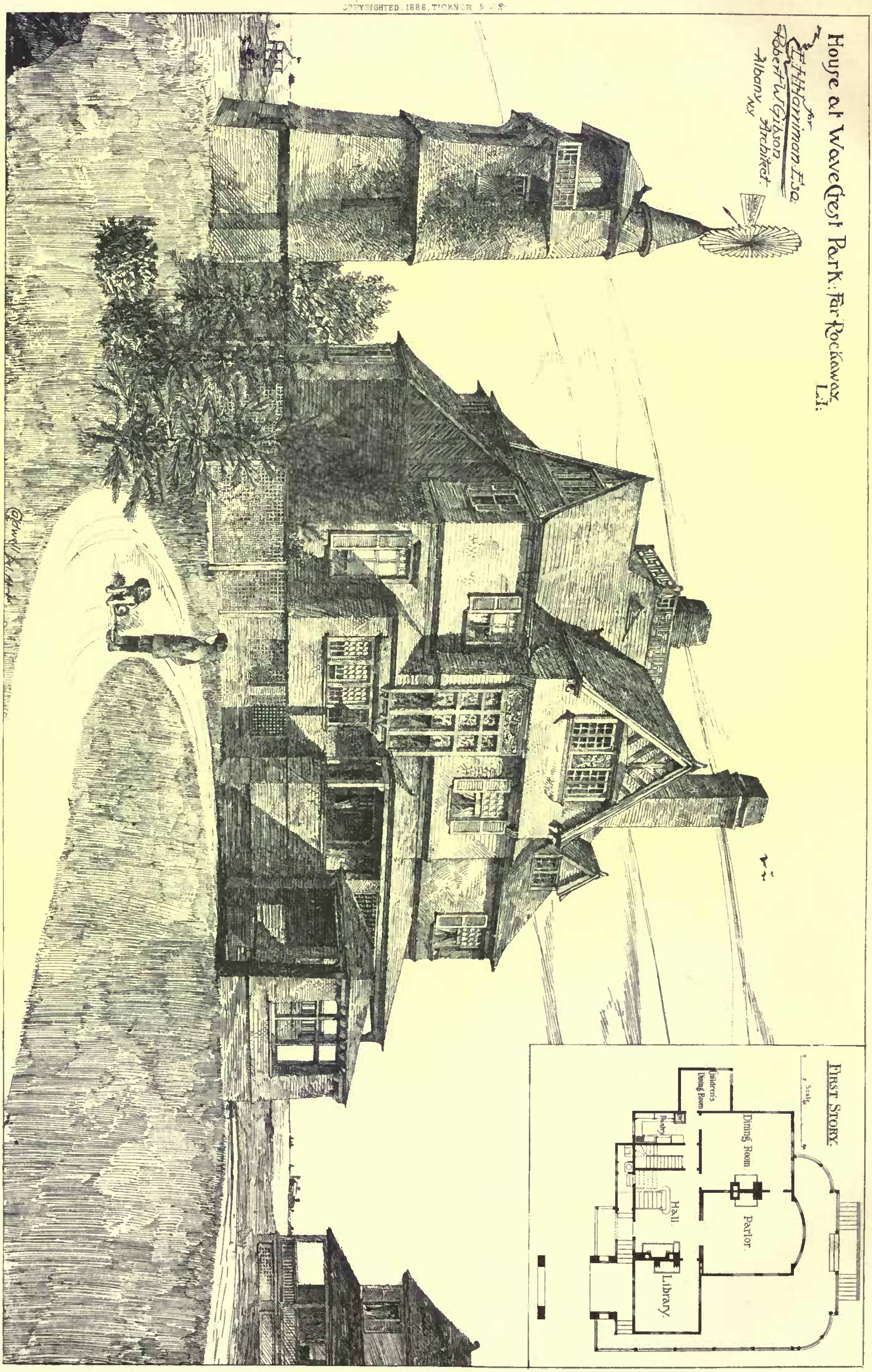
Or, in the drawing of the truss itself the lines are called, not by letters placed at the ends of the lines, but by letters placed *each side* of the lines, the lines being between; it is also usual to put these letters in capitals to distinguish them from the letters representing the strain diagram, which are, as usual, at *each end* of the line they represent.

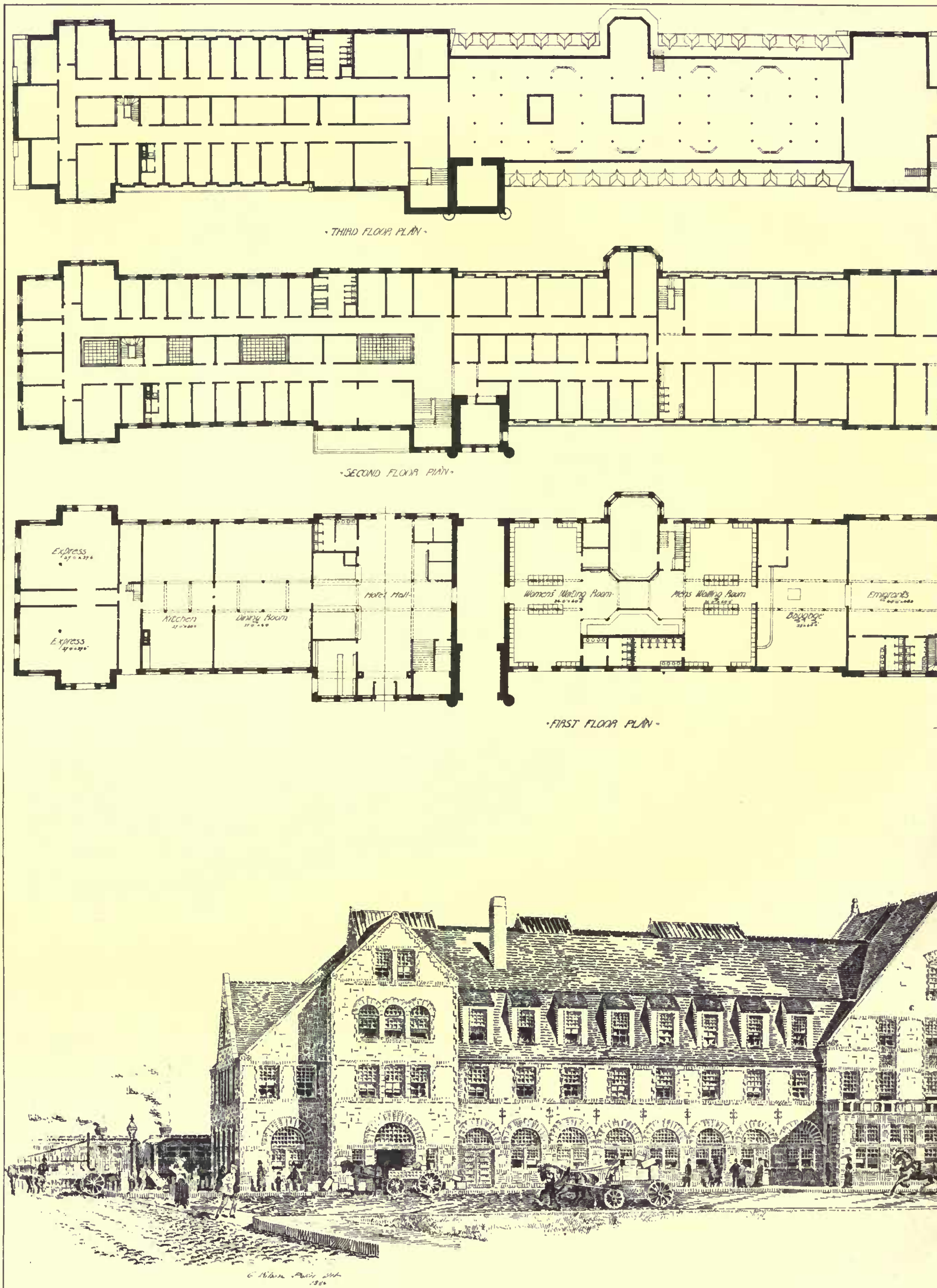
[1] Continued from No. 562, page 158.

[1] Continued from page 159, No. 562.

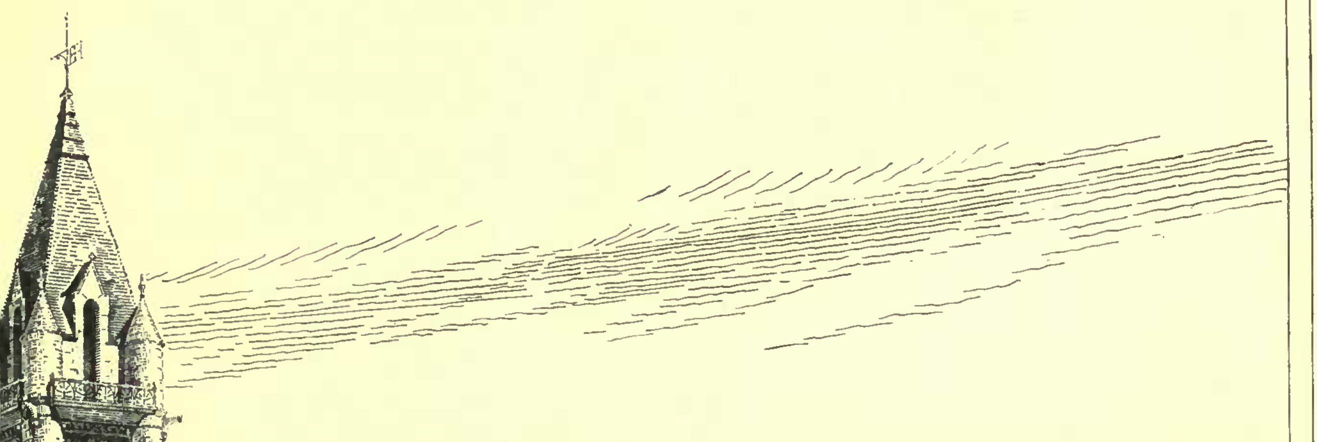


"American Architect" Competition for a House to cost $5000 on a County Hillside by "Lawn Tennis"
Hall Mantel
Center Line
Newel
Handrail
Rail
Pickets
Turned Balusters
Veranda Railing
View in Hall
Railing at Front Porch
Water-table
Eaves
Shelf
Window Frames
Sill
Jamb
Top
Porch Cornice
Belt
Gable over Stair Landing
Section at AA
Clapboards
Base
Overhanging Cornice
Window Head in Front Gallery
Heights
Scales
1st Story Cornice
2nd Story Cornice
Rear Elevation
4th Room
Servants Room
Veranda
Reception Room
Living Room
Hall
Dining Room
Library
Kitchen
Porch
Plants
First Floor Plan
Chamber
Family Chamber
Children's Room
Bed Room
Second Floor Plan


House at WaveCrest Park: Far Rockaway, L.I.
for E. H. Harriman Esq.
Robert W. Gibson, Architect
Albany, N.Y.
First Story
Scale
Children's Dining Room
Pantry
Dining Room
Hall
Parlor
Library

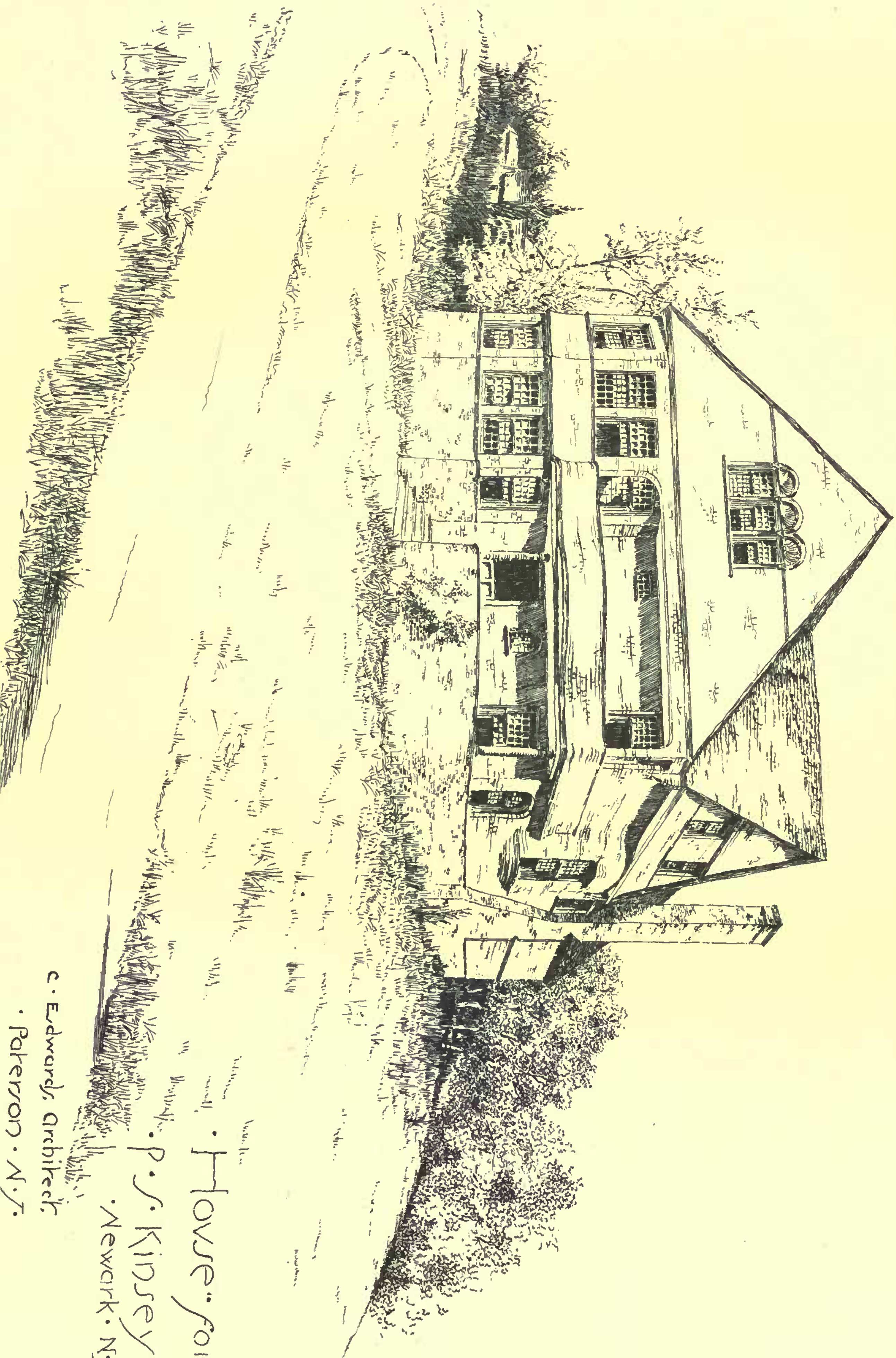


UNION PASSENGER STATION AT OGDEN, UTAH



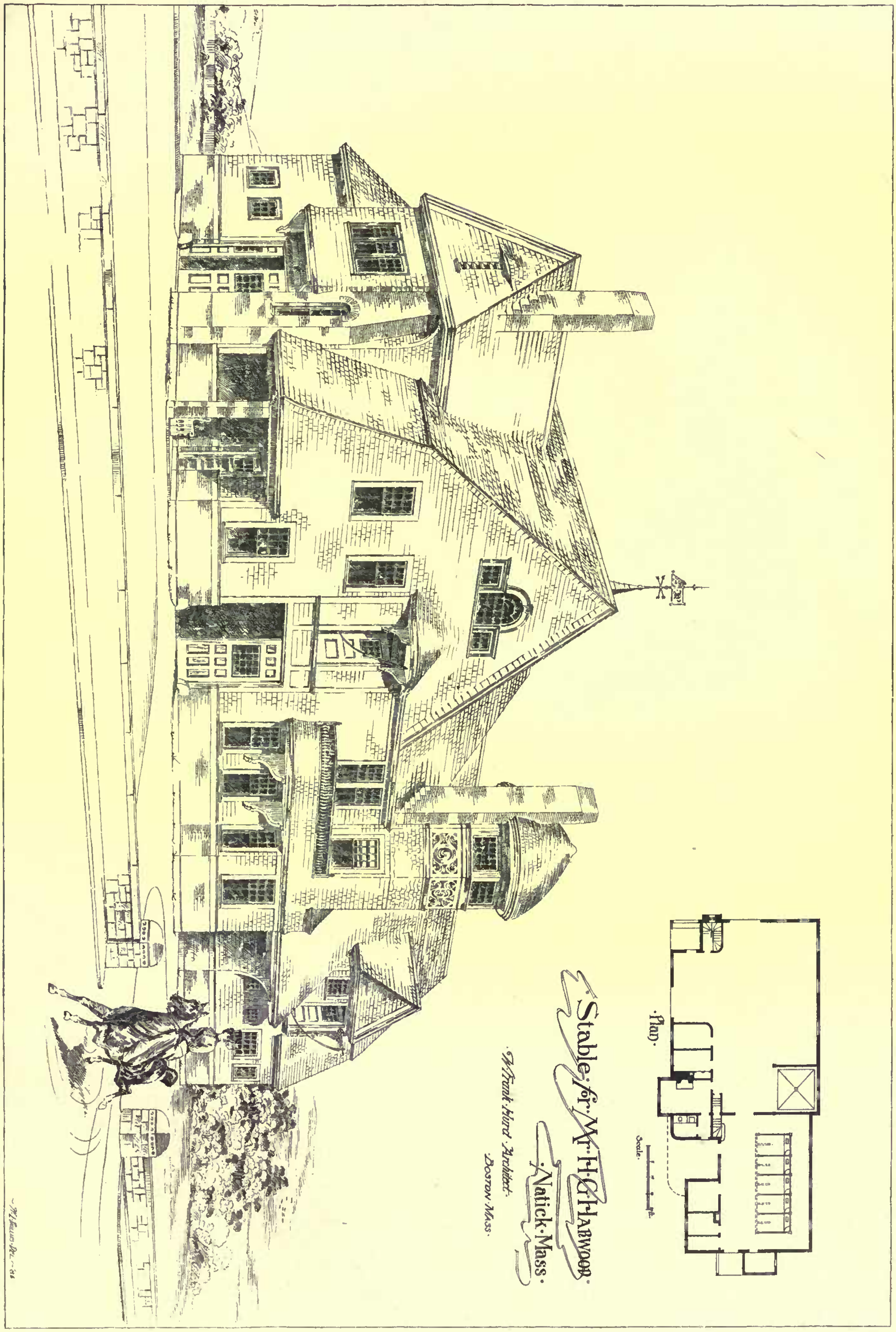
‹VAN BRUNT & HOWE ARCHITECTS, BOSTON & KANSAS CITY‹

The Heliotype Printing Co Boston.



·House·for·
·P·S·Kinsey·Esq·
·Newark·N.J·

C·Edwards, Architect,
·Paterson·N.J·



The Heliotype Printing Co Boston

One thing is *very important*, however, and that is, always to read the pieces off in the *correct direction* and in their *proper order*. For instance, if we were examining the joint at middle of left rafter we must read off the pieces in their proper order, as B C, C I, I K, K B, and not jump, as B C, I K, C I, etc., as this would lead to error. Still more important is it to read around the joint in one direction, as from left to right (Fig. 18), that is, in the direction of the arrow. If we were to reverse the reading of the pieces, we should find the direction of the strain or stress reversed in the strain diagram. For instance, if we read K I and then find its corresponding line *k i* in the strain diagram, we find its direction downward, that is, pulling away from the joint, which would make K I a tie-rod, which, of course, is wrong, as we know it is a strut. If, however, we had read correctly *i k* it would be pushing upwards, which, of course, is correct and is the action of a strut.

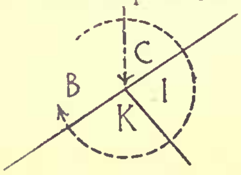


Fig. 18.

When we come to examine the joint at O, however, we reverse the above and here have to read *k i*, which is in the same relative direction for the point O, as was *i k* for the point at centre of left rafter.

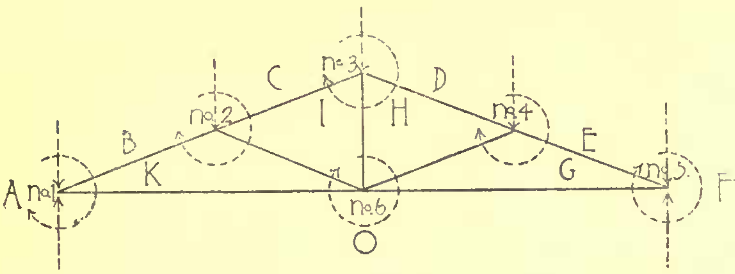


Fig. 19.

The arrows in the accompanying figure (19) show how each joint must be read, and *remember* always to read the pieces in their proper succession.

It makes no difference with which joint or with which piece of the joint we begin, so long as we read in correct succession and direction, thus: for joint No 1 we can read

A B, B K, K O and O A
or K O, O A, A B and B K,
or B K, K O, O A and A B, etc.

In the strain sheet of course we read in the same succession, and it will be found that the lines, as read, point *always* in the correct direction of the strain or stress.

PARALLELOGRAM OF FORCES.

Parallelogram of Forces. If a ball lying at the point A, Fig. 20, is propelled by a power sufficient to drive it in the direction of B, and as far as B in one minute, and at B is again propelled by a power sufficient to drive it in the direction of and as far as the point C in another minute, it will, of course, arrive at C at the end of two minutes, and by the route A B C.

If, on the other hand, both powers had been applied to the ball simultaneously, while lying at A, Fig. 21, it stands to reason that the ball would have reached C, but in one minute and by the route A C. A C (or E D), is, therefore, called the resultant of the forces A E and D A. If, now, we were to apply to the ball, while at A, simultaneously with the forces D A and A E, a third force (E D) sufficient to force the ball in the opposite direction to A C (that is, in the direction of C A), a distance equal to C A in one minute it stands to reason that the ball would remain perfectly motionless at A, as C A being the resultant (that is, the result) of the other two forces, if we oppose them with a power just equal to their own result, it stands to reason that they are completely neutralized. Now, applying this to a more practical case, if we had two sticks lying on A E and D A, Fig. 22, and holding the ball in place, and we apply to the ball a force E D = C A and in the direction C A, we can easily find how *much* each stick must resist or push against the ball. Draw a line *e d*, Fig. 23, parallel to E D, and of a length at any convenient scale equal in amount to force E D; through *e*, Fig. 23, draw *a e* parallel to A E, and through *d* draw *d a* parallel to D A, then the triangle *eda* (not *ead*) is the strain diagram for the Fig. 22, and *d a*, measured by the same scale as *e d*, is the amount of force required for the stick D A to exert, while *a e*, measured by the same scale, is the amount of force required for the stick A E to exert. If in place of the force E D we had had a load, the same truths would hold good, but we should represent the load by a force acting downward in a vertical and plumb line.

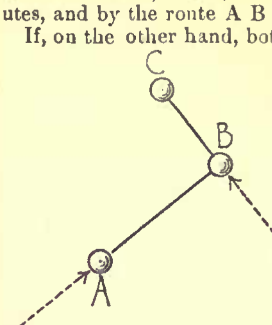


Fig. 20.

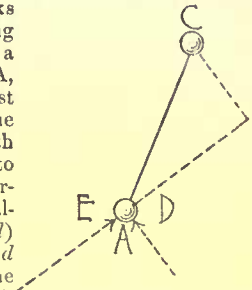
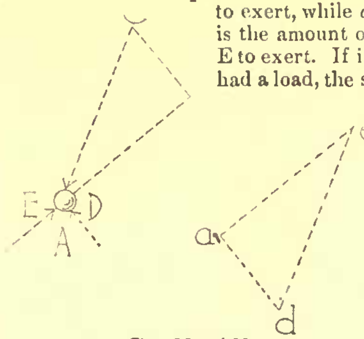


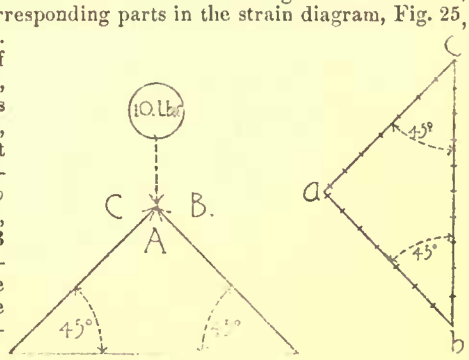
Fig. 21.



Figs. 22 and 23.

Thus, if two sticks, B A and A C, Fig. 24, are supporting a load of ten pounds at their summit, and the inclination of each stick from a horizontal line is 45°, we proceed in the same manner. Draw *c b*, Fig. 25, at any scale equal to ten units, through *b* and *c* draw *b a* and *a c* at angles of 45° each, with *c b*, then measure the number of (scale measure) units in *b a* and *a c*, which, of course, we find to be a little over seven. Therefore, each stick must resist with a force equal to a little over seven pounds.

Now, to find the direction of the forces. In Fig. 24 we read C B, B A and A C, the corresponding parts in the strain diagram, Fig. 25, are *c b*, *b a* and *a c*. Now the direction of *c b* is downwards, therefore C B acts downwards, which is, of course, the effect of a weight. The direction, however, of *b a* and *a c* is upwards, therefore B A and A B must be pushing upwards, or *towards* the weight, and therefore they are in compression.



Figs. 24 and 25.

The same truths hold good no matter how many forces we have acting at any point; that is, if the point remains in equilibrium (all the forces neutralizing each other), we can construct a strain diagram which will always be a *closed* polygon with as many sides as there are forces, and each side equal and parallel to one of the forces, and the sides being in the same succession to each other as the forces are. We can now proceed to dissect a simple truss.

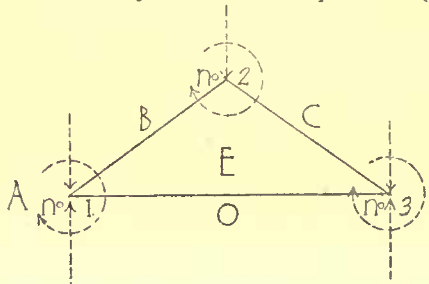


Fig. 26.

Roof Trusses. Take a roof truss with two rafters and a single tie-beam. The rafters are supposed to be loaded uniformly, and to be strong enough not to give way transversely, but to transfer safely one half of the load on each rafter to be supported on each joint at the ends of the rafter. We consider each joint separately. Take joint No. 1, Fig. 26.

GLOSSARY OF SYMBOLS.—The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.:—

a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
f = *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g_1 = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches. [See Table I.]
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right-hand re-action* (or support) of beams, in pounds.
r = *moment of resistance*, in inches. [See Table I.]
s = *strain*, in pounds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
𝔡 = *diameter*, in inches.
𝔯 = *radius*, in inches.
π = 3.14159, or, say, 3.1-7 signifies the *ratio of the circumference and diameter of a circle*.

If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_{I}, a_{II}, a_{III}, etc., or b, b_{I}, b_{II}, b_{III}, etc.

In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance:—

m = moment or bending moment at *centre*.
m_A = " " " *point A.*
m_B = " " " *point B.*
m_X = " " " *point X.*
s = strain at *centre*.
s_B = " *point B.*
s_X = " *point X.*
v = stress at *centre*.
v_D = " *point D.*
v_X = " *point X.*
w = load at *centre*.
w_A = " *point A.*

We have four forces, one O A (the left-hand reaction), being equal to half the load on the whole truss; next, A B, equal to half the load on the rafter B E. Then we have the force acting along B E, of which we do not as yet know amount or direction (up or down), but only know that it is parallel to B E; the same is all we know, as yet, of the force E O. Now draw, at any scale, Fig. 27, No. 1, $o\,a =$ and parallel to O A, then from a draw $a\,b =$ and parallel to A B ($a\,b$ will, of course, lap over part of $o\,a$, but this does not affect anything). Then from b draw $b\,e$ parallel to B E, and through o draw $e\,o$ parallel to E O. Now, in reading off strains, begin at O A, then pass in succession to A B, B E and E O. Follow on the strain diagram Fig. 27, No. 1, the direction as read off with the finger (that is, $o\,a$, $a\,b$, $b\,e$ and $e\,o$), and we have the actual directions of the strains. Thus $o\,a$ is up, therefore pushing up; $a\,b$ is down, therefore pushing down; $b\,e$ is downwards, therefore pushing against joint No. 1 (and we know it is compression); lastly, $e\,o$ is pushing to the right, therefore pulling away from the joint No. 1, and we know it is a tie-rod. In a similar manner we examine the joints 2 and 3, getting the strain diagrams No. 2 and No. 3 of Fig. 27. In Fig. 28, we get the same results exactly as in the above three diagrams of Fig. 27, only for simplicity they are combined into one diagram.

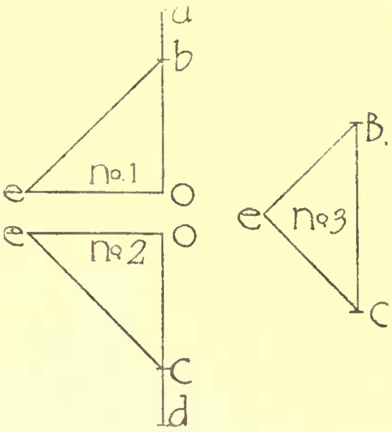


Fig. 27.

If the single (combination) diagram, Fig. 28, should prove confusing to the student, let him make a separate diagram for each joint, if he will, as in Fig. 27. The above gives the principle of calculating the strength of trusses, graphically, and will be more fully used later on in practical examples.

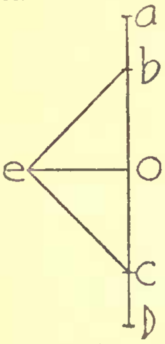
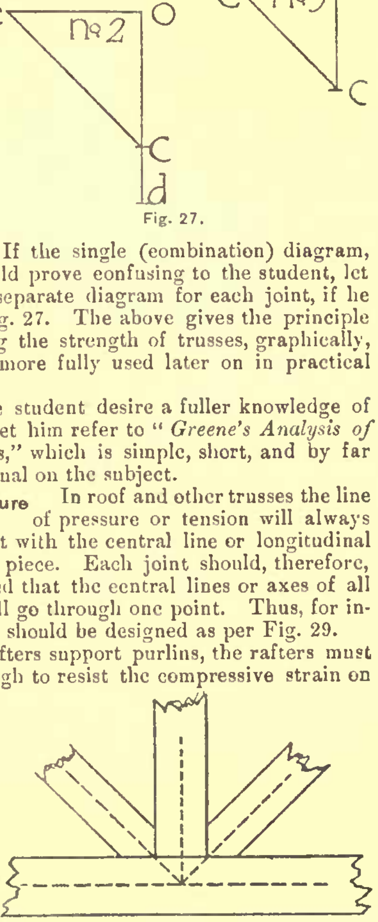


Fig. 28.

Should the student desire a fuller knowledge of the subject, let him refer to "*Greene's Analysis of Roof Trusses*," which is simple, short, and by far the best manual on the subject.

Line of Pressure Central. In roof and other trusses the line of pressure or tension will always be co-incident with the central line or longitudinal axis of each piece. Each joint should, therefore, be so designed that the central lines or axes of all the pieces will go through one point. Thus, for instance, the foot of a king post should be designed as per Fig. 29.

In roof-trusses where the rafters support purlins, the rafters must not only be made strong enough to resist the compressive strain on them, but *in addition to this enough material must be added* to stand the transverse strain. Each part of the rafter is treated as a separate beam, supported at each joint, and the amount of reaction at each joint must be taken as the load at the joint. The same holds good of the tie-beam, when it has a ceiling or other weights suspended from it; of course these weights must all be shown by arrows on the drawing of the truss, so as to get their full allowance in the strain diagram. Strains in opposite directions, of course, counteract each other; the stress, therefore, to be exerted by the material need only be equal to the difference between the amounts of the opposing strains, and, of course, this stress will be directed against the larger strain.


Fig. 29.

A Tall Chimney. — A chimney was built in 1885 for a lead-smelting works at Pueblo, Cal., which is 319 feet in height, 10 feet in diameter in the clear from the foundation up. It rests on 16 feet of smelter slag, which was poured in a liquid state in the ground 16 feet deep, and allowed to cool and solidify. On top of this, and above ground, is a second foundation 16 feet high, made of brick. The stack proper, which is 287 feet high, is made of iron and lined with fire-brick. It is the largest stack west of the Missouri River.

Fire from Heated Asbestos.— Fire originating from heated asbestos intended as sheathing is noted by a patrol inspector in Philadelphia. In one or two recent instances the combustion chamber of a regenerative gas lamp was too near certain woodwork, and asbestos was inserted between, but the heat soon penetrated the stratum of asbestos and set fire to the wood. In the other case the sheet-iron top of a portable heater was within a few inches of the joists of first floor; asbestos was placed on the heater, but heat passed through and the joists took fire. Heat was always above 300° Fahrenheit, and confined. No fires were noted from steam-pipes sheathed in asbestos. The inspector recommends as a safeguard from the heating of the non-inflammable fibrous stone an unobstructed air-current between the source of the heat and the asbestos covering.—*Iron Age.*

TAKING OUT QUANTITIES.



ALTHOUGH the following rules apply to English practice, they seem so comprehensive in themselves as to make it worth while to reproduce them in *extenso*.

The Manchester Society of Architects has just issued a revised edition of their General Statement, originally published nearly fourteen years since, of the methods recommended to be used in taking quantities and measuring up works. It is thirteen years since the last revision was undertaken, and although in some matters the directions cannot apply all over the country, we think the Statement is worth reproducing, and that the Manchester Society of Architects has done well to reissue it.

In taking quantities it will always be desirable to bear the character of the works in mind, and so to measure and describe them as to give parties estimating the clearest idea, and at the same time in the most concise manner, of their cost and character. In measuring up works already executed it is, of course, only necessary to ascertain on what principle of measurement the prices have been determined, and then proceed accordingly.

GENERALLY.

Fees to corporation, hoarding, propping sides of foundations or walls, and use of water for the different trades, to be mentioned in the trade that has to provide them, or under the head of charges to be borne by the general contractor. (If the right of advertising on hoarding is to be reserved by the proprietor, it should be so stated.) Each trade to provide its own scaffolding, unless specially mentioned. Each trade to provide its own mortar. Protecting masonry with slabs, etc., to be put by preference in carpenter's work. Expense of watchman, making good damaged work, etc., to be inserted as occasion may arise. Each trade to provide for the expense of the attendance on the other tradesmen, and for cutting holes, and making good, etc. When the general contractor is expected to be responsible for damage by fire, an item for insurance to be put in the quantities, by preference in the carpenter's work. Any provision of sums of money or values for articles shall denote the net cash to be paid by the builder, exclusive of his profit and the cost of materials and labor required for fixing, which, however, should be fully stated. Clerk-of-work's office and custody of drawings to be provided for.

EXCAVATOR.

1. Stripping surface-soil — deep, and wheeling in heaps — yards run, to be measured in superficial yards. 2. Excavating to be given in cubic yards, measured to three inches beyond the outer edge of footings; with extra beyond for batter of sides of excavation, depending on depth and nature of soil. State whether material is to be left on the ground or carted away; and if wheeled, state the distance. Extra price for wheeling every twenty yards run additional. The excavating for each successive depth to be kept separate, and the nature of the material to be excavated to be mentioned if possible. 3. Excavating to trenches for walls, etc., to be measured in cubic yards, and to be kept separate from the above, as also for underpinning or any special work that has to be executed separately. 4. Filling in and ramming to foundations, to be given as an item, or, if thought desirable, to be done by day-work. 5. Clearing away rubbish from time to time, to be given as an item. 6. Filling in, or forming foundation for paving and flagging, to be taken in superficial yards, and state depth and material; or add this to the item of paving or flagging in mason's work. 7. Drains to be given in lineal yards with description thereof, to include cutting trenches and laying; describe method of jointing and filling in; and state average depth of each kind, and, when practicable, mention whether in rock or other kind of ground. 8. Junctions, bends, etc., to be counted extra beyond the length of drains. 9. Cutting trenches and filling in to gas and water pipes (see Plumber), to be given in lineal yards. 10. Wells, cesspools, eyes, etc., to be given with proper particulars, as the work may require. 11. Keeping foundations clear of water beyond ordinary rainfall, or for propping to streets or adjoining buildings, to be given as items.

BRICKSETTER.

1. Give description of materials and mortar and quality of work. The work, unless otherwise mentioned, to be reduced to one brick thick, and called "brick-length walling," in yards superficial. If sand, gravel, or water, on the spot is not intended to be used, state

so. If there be much work of half a brick only it is desirable to mention it. Where a building is lofty it is desirable to divide the work into stages vertically. 2. To obviate any misunderstanding as to so-called trade usages, with regard to other materials, as stone, etc., built in, it is proposed to measure the net quantity of brickwork to be executed; deducting entirely all labor and materials in openings having more than 100 square feet "*face*" measure and deducting materials only (leaving "hollows" for labor) on the following:

(*a*). All other openings than the above, the shape they are actually executed, provided they are openings in the walls and built above with the same materials.

(*b*). All sills, strings, cornices, etc., and other masonry or dressings built in, and being six or more inches high. The "hollows" thereon being assumed to pay for the labor in providing proper bed therefor, filling up thereto, and pointing up.

(*c*). Fireplace openings from underside hearth, and all flues, to be deducted as "hollows," and the lineal dimensions of flues (with size, if various), to be given for extra labor forming, pointing and coring out.

3. Joists and beam-ends, wall-plates, door-frames, band and gudgeon-stones, codge-stones, beam-stones of ordinary dimensions, not to be deducted if built in with the work. 4. All walls finished with a bevelled upper edge, as to gables, eaves, etc., to be measured to three inches above the average height; and the lineal dimensions of "beam filling" between spar feet and of "gable cutting" given. 5. Any work intended to be whitewashed, to be measured "superficial," over all openings for pointing. 6. All splay cutting (with width), bevelled arrises, moulded arrises, bands of fancy work (with description), cutting to any shape not square, for ramps, hood-moulds, etc., etc., double or other shaped reveals, to be given lineal. 7. Stops to chamfers, and other single points requiring special labor to be counted. 8. All brickwork in projecting bands, cornices, etc., to be measured as walling, the labor as above in number 6. 9. Facing to be measured superficial for "extra price over common;" and the net quantity executed only to be given, after deducting all strings, sills, etc., etc. All openings less than 100 feet to be deducted and kept separate as "hollows for extra labor over common work," to pay for the labor, plumbing, and setting out. Reveals to be measured for facing separately. 10. Cavity walling to be measured the actual thickness of the bricks, as, for instance, to be measured at one and one-half bricks or two bricks, etc., as the case may be; and the superficial dimension of the wall measured across all openings under 100 square feet, as "extra labor and extra materials for bond, forming cavity walls." The nature of the ties to be mentioned. 11. Work in cement or other material than the general run, to be taken for "extra price over mortar," and the description of the material given. 12. Backing up to ashlar walling to be kept separate from the ordinary walling. 13. Wrought-iron bond, if used, to be given in lineal feet. 14. Common relieving arches to be counted with average span, and separated into various thicknesses of wall, and number of rims in depth, and this to cover all extra labor and materials. 15. Arches in facing to be either counted, with spans, depth, and soffit given, and this to include all extra labor and materials, including skewbacks, and cutting super-imposed work to fit the rake; or else measured superficial as executed, for "extra labor and materials over facing;" girthing the face and soffit net, and measuring separately the skewbacks, and cutting super-imposed work to fit the rake, when the shape of the arches requires it. 16. Ordinary arching to fireproof floors, etc., to be measured stuff and work in square yards, with description and thickness, girthing along the line of average thickness, and measure the lineal feet of skewbacks with description. Groins to be measured lineal. Allow for cutting and fitting to ironwork. 17. Trimmer arches to be counted, with average size, for "stuff and work," including backing-up, and state whether solid or concrete backing is intended. 18. Backing to arches that have been measured, as in number 16, to be taken superficial, with average thickness and description of material. 19. Damp-proof courses to be given lineal with widths. 20. Risers for slopstones, steps, flagshelves, etc., to be counted for "stuff and work," or, if measured as walling, to be kept separate, and so stated. 21. Wine-bin divisions measured superficial, with thickness, and kept separate, or with the above. 22. Eyes, air-grids, chimney-pots, setting-grates, or other special items, to be counted, with description, and the mode of executing the work. 23. Covering walls to protect them on special occasions, and manner of doing it, to be added to the bricksetter's contract. 24. Items: to cleaning down, making good, pointing, etc., at finish. 25. It would be well to call the contractor's attention to the fact that his price must include making good any damage done by frost. 26. Concrete in foundations to be measured by the cube yard.

MASON.

1. Plain ashlar walling and parpoint walling to be measured superficial, net work, for "stuff and work," giving the kind of face, and average sizes and bed of stones; allowance to be made where square blocks have to be cut to suit shaped openings, ramps, etc., and defining the number and dimensions of the through stones. Reveals to be measured extra. Rubble walling up to eighteen inches in thickness to be measured superficial and described; above that thickness to be measured in the cube and described. 2. Other masonry to be measured as hereafter mentioned, keeping the stone and labor separate, or when conducing to the better understanding of the work, as in strings, etc., to be measured in lineal feet, "materials and labor," with sufficient particulars to enable the number of joints to be included; count the fair ends, quoins, etc. 3. Work in chimneys, or cornices, etc., requiring special appliances for hoisting, or at considerable heights, or of extra dimensions, to be kept separate, so far as the material, hoisting, and setting are concerned; the labor, when done on the ground, may be thrown in with the rest. 4. Under the head "stone" must be included the labor in hoisting and setting, and state approximately the quantity to be set above forty feet from the ground. 5. Special appliances for hoisting, such as travelling-cranes, etc., to be specially mentioned. 6. In measuring the cubic feet of stone for other than the work previously mentioned, one inch each way beyond the net dimensions of each block, when worked, to be added. 7. In measuring the labor, the necessary operations of the workman to be followed. The beds and joints of each block to be measured, and kept under that head; and it will conduce to more easy pricing of the work when these can be given in lineal feet, with the average width, particularly for strings, cornices, architraves, jambs, etc. 8. The work exposed to sight to be classified under its different heads, mentioning whether basted, tooled, or polished, and giving plain work, sunk, moulded, sunk and moulded (this when the straightedge will not work the block from a mould applied at each end), weathered, sunk and weathered, and the various kinds of fancy surfaces, and clearly distinguishing from straight work that which is raking, circular, circular on circular, etc. 9. Raised or sunk panels will require that face of the block to be first measured for plain work (for setting out on), then the face work, and the lineal feet of margin of its particular kind. 10. The points from which to girth moulded work will be best ascertained by a consideration of the manual process followed in its execution; in some strings it will thus have to be girthed from wall above to wall below; in other instances, as cornices, where the top is measured for sunk and weathered work, the moulded work will girth from the nose only. 11. All mitres to be counted, with the girth of the mould, etc., they belong to, and state whether internal or external. 12. Throats to be clearly given, either separately in lineal feet, where the soffit has been measured as a "bed," or, in other instances, girthed in with the moulded work. 13. The back of masonry will not generally require any notice, except where it shows through a wall that is not plastered, and in some quoins that bed more than the thickness of the walls, where the sinking must be taken into account. Tooling or rubbing backs of architraves, mullions, etc., to bed frames against, to be measured lineal, and all checking out for the same purposes to be measured in the same way. 14. Holes for flues, timbers, etc., to be counted. 15. Rough sinking down as a preparation for the carver to be given superficially, girthing round the cap, truss, etc., etc. 16. All carving to be clearly set forth with reference to the drawings or special marginal sketches; running ornaments to be given lineal with the girth; but caps, bosses, trusses, modillions, pateræ, etc., numbered. State if carver is to find his own scaffolding. 17. Ordinary window sills to be numbered, with dimensions. 18. Others than these to be taken cube, and the labor taken out as before, and in addition the seats counted for jambs, mullions, etc. 19. As tracery will generally be of a description between the work of an ordinary mason and that of a carver, the most satisfactory way would appear to be to measure one face over all the work as plain work for setting out on, and then number each piece of tracery with its dimensions and reference to the drawings or special marginal sketch for the remainder of the labor, but measuring separately any groove or rebate for glazing. 20. Mullions and other work with little material, as compared with the labor, to be measured lineal, "stuff and work," with particulars or sketch, and give general indication of the lengths. 21. Columns to be girthed for circular work (with or without entasis, as the case may be), and flutes measured lineal with sketch, and number of stops counted; if in extra lengths, keep both materials and labor under a separate head. 22. Rustics and other channelled work to be measured lineal (after the surface and beds have been fully measured), with sketch. 23. Cramps and dowels to be counted, with average size or weight, if metal, and letting in and running; and state whether mason is to find lead. 24. Copings, where worked out of flags or thin material, to be measured lineal, and net as fixed, with proper description of each face and mode of jointing. All knees, apex, and foot-stones to be counted with sketch or particulars of labor thereon. Any perforations for flues, etc., to be counted. 25. Flagging to be measured net, in square yards, with proper description of materials, average and minimum size of flags, method of jointing and laying; and whether mason to provide bed and mortar, and if so, describe same. All exposed nosings to be measured lineal; and any perforations or notchings cut to fit special corners or other objects, to be counted or measured, and the portion so notched out of any flag included in the gross measurement. 26. Flags, if required to be above twelve feet superficial, to be kept under the head of "landings." 27. Any special mode of jointing flags or landings, as lap or joggle joint, to be measured once along the joint. 28. Hearths to be given in superficial feet, and if the fore and back hearth be in one piece, state "large sizes," and count the notchings for jambs. 29. Paving to be measured net, with description of sets and method of laying, and whether mason finds the bed or not. 30. Keep each kind of tiling to floors separate, and state whether and what kind of bed is to be provided. 31. Bond and gudgeon stones, codge stones, beam and pillar stones to be counted, with dimensions and particulars of work thereon, and whether mason has to let it and

run any iron work therein, or to find lead therefor. 32. Steps, where practicable, are best counted, with dimensions and particulars; solid steps may be taken lineal, with average length, and count the number for pinning in, and also the worked ends. All letting in of balusters, newels, etc., to be clearly given, and joggle or notched joints measured. 33. Landings, half spaçes, etc., to be either counted with description or taken superficial, with all joints, worked edges, and soffits measured. 34. Letting in of grids to drains, coal-places, areas, etc., to be counted, and state whether lead to be found, and if the stone or curb has to be rebated state so. 35. Area and other curbs to be taken lineal, and if cramped, so stated, with average lengths of stone. 36. Dubbing out with flags, for cornices, etc., for the plasterer, to be taken lineal, with width and thickness, and any special labor. 37. Slopstones, etc., to be either counted with particulars, or measured superficial, with the labor, the sinking to be girthed bottom and sides each way; mention the hole for grid, and whether to be fixed by the mason. 38. Mason's work generally requires very minute subdivision in measuring, and a knowledge of the method of working stone is essential to the proper performance of that duty. Each necessary operation of the workman should be taken into account, although it may appear that the same surface (as in panelled or enriched work, etc.), has to be measured more than once for different descriptions of work. 39. Clean down and leave all perfect at completion as an item.

CARPENTER AND JOINER.

1. Unless a special provision be made that timber and joiner's work must finish net to the dimensions given (the waste being calculated then in the price), it must be understood that all work will follow the original marking or "pricking" for sawing; thus each sawn face would reduce the scantling by nearly one-sixteenth of an inch, or half the width of sawcut, and each wrought face would entail a further reduction of about one-sixteenth of an inch. A twelve by six inch scantling would thus measure eleven and seven-eighths inches by five and seven-eighths inches full, and a two-inch door would finish one and three-fourths inches full. 2. Labor, framing and nails to be measured superficial, in square yards, for floors, roofs, and ceiling joists; keeping the different descriptions, whether for single-joisted or framed, separate, and defining the mode of framing, and taking the dimensions over the extremities of the timbers, or the timber may be taken cube and to include the labor. 3. Labor framing principals to be measured the length of span, with wallhold, and separating the different kinds; the same with framing trussed partitions. 4. Ordinary studded partitions, and filling-in to the above, to be taken superficial, in yards, for "stuff and work," with scantlings and distances apart. 5. Labor framing hips and valleys in lineal feet. 6. Gutters lineal, or, if wide, superficial, and state if with bearers; count cesspools, with dimensions. 7. The timber to be taken cube when sawed to scantling, keeping as far as practicable, large scantlings, as beams, purlins, large joists, etc., separate from small, as spars, plates, etc. Beams are best given in lineal dimensions, and when over thirty-five feet long should be kept separate. 8. When conducing to the better understanding of the work, however, large timbers, or those with special labor, to be measured lineal and properly described. 9. Deals, planks, and battens, used for joists, etc., to be taken superficial or cube. 10. Planing or other special labor to timbers measured superficial or lineal in feet, and stops to beads or chamfers counted. 11. All timbers to be measured net lengths as fixed, and trimmings for hearths, wells, skylights, etc., counted. 12. Angle beads, staff beads, and tilting fillets in lineal feet. 13. Bolts, dogs, straps, etc., of iron to be counted, keeping joint-bolts separate from others. 14. Nogs and templates to be counted or kept separate under a cube or lineal dimension. 15. Snowboards, in lineal feet, with width and description. 16. Ridge and other rolls, and hip and valley boarding, in lineal feet, with width. 17. Centreing, in square yards, except centres for doors and window-openings, etc., which are to be counted, with span and width. In extensive fireproof works, a small quantity of centreing will often suffice if "taking down and refixing" be given, together with the necessary staying. 18. Cornices and face-boards in lineal feet, with description and particulars of bearers, etc., and count mitres to the former. 19. Ordinary flooring in square yards net; mitred margins to be counted. 20. Pugging to floors, measure across the timbers and state description, whether on slabs and fillets, or laths, and if filled in, describe. 21. Skirtings in lineal feet as fixed, with dimensions and description, and state whether to include grounds; where above seven inches, count all mitres and ramps, and labor of housing to architraves, chimneypieces, etc.; if tongued to floor-board, state so. 22. Door-casings and frames in lineal feet (allowing length for tenons, etc.), and state whether framed, and number of rebates; count frames for dowelling. 23. Doors, grates, etc., net size, in superficial feet, allowing for rebate in folding-doors, keeping each description separate, and state if flush-beaded at meeting edges, or for double margins, etc.; hanging to be counted and described, locks and other fittings at a price each and labor fixing; bolts to dimensions, and ditto. 24. Architraves in lineal feet, net measure, and state if with grounds, and, except for single moulds up to three inches, count all mitres, or special adaptations; blocks to be counted in pairs, including all labor-fitting architraves thereto. 25. Window sashes and frames to be measured full size of frames; if not square headed, state so, or else count the heads for extra price, with description; state if extra strength be required in any part of frame, or any particular way of working weatherings, sinkings, etc. 26. Casement sheets and frames to be measured separately and as above, with scantlings. 27. State if holdfasts or other particular mode of fixing frames be required. 28. Skylights to be measured full size. Any portion of a sheet made to open, to be measured again in addition, if it is a separate piece of framing, and any grooving, whether fillets, etc., accounted for. 29. Window backs and elbows, and soffits, and linings, worked one side only, to be kept separate from shutters, and state if to have grounds; if linings are under nine inches wide, take lineal, with the width. Plinths and capping and flush beads to be measured lineal. Hanging sheets and casements to be counted, with particulars of pulleys, cords, weights, hinges, fastenings, etc. Hanging shutters and backlaps ditto. Window bottoms lineal, and count returned ends. 30. Bracketing for cornices in lineal feet, with girth or sketch of brackets, and distances apart. 31. Coves, superficial feet for stuff and work. 32. Cradling round beams, superficial for stuff and work. 33. Bridging for floors in lineal feet, and state whether slab or herring-bone bridging, also whether tie-rod or hoop is to be used. 34. Wall-boarding and dadoes in superficial feet, and give lineal feet of grounds, and also fitting to architraves, etc. 35. All casings to underside beams, gutters, cistern, etc., in superficial feet, with description, or else lineal, with girth and number of beads. 36. Pipe-casing, ditto, and state if to be fitted with screws, for taking down at pleasure. 37. The different items of water-closets to be kept separate, and state if fitted with screws, etc., to take down; seat and bearers, fall and frame, riser, all superficial; skirting, superficial or lineal, according to requirements; capping separate. Holes cutting, falls hanging, hinges, paper boxes, etc., and attendance on plumber to be counted. 38. For bath framing take riser and skirting as for water-closets; bearer for curb lineal; curb lineal, with average width or superficial. 39. French polishing to be, where practicable, measured separately in superficial feet. 40. Fixtures require careful measurement in detail; skeleton-fronts for drawers and small cupboard fronts separate from the fronts themselves; bearers, false-bottoms, drawers fitting with stops, hanging-doors, knobs, and other fastenings, divisions, guides, etc., all to be taken into account; shelves with widths and bearers or brackets, also hook-rails, all lineal. 41. Stairs, in ordinary cases, to be counted, with dimensions, and state whether returned nosings and cut-string boards, notch boards, and number of carriages; measure hand-rail and balusters, and newels separate; and casing and nosing, hand-rails and balusters along landings; count ramps, scrolls, curtain-ends, and circular corners to wells; give spandrel framing separate from square framed work; state French-polishing; landings to be taken superficial in feet, including bearers and nosings, etc., at the edge, to be taken lineal. 42. All other items of ironmongery to be counted, with particulars, or price and labor fixing in addition. 43. All circular work throughout to be kept separate from straight work. 44. Enter up reserved amounts, provisions of materials, or cash, etc., and clearly state if such are to include contractor's profit or to be deducted in full. 45. The carpenter generally undertakes the fixing of the ironwork, and in many instances it might be desirable to put the fixing and staying during erection in his quantities, giving the weight of cast and wrought iron beams, etc., and counting the bolts, rods, etc. 46. Insurance, if to be provided for by the carpenter, to be entered.

PLASTERER AND PAINTER.

1. State description of materials, and keep the work of each kind separate. 2. Plastering on walls to be measured from the floor upwards, or from the point where each description of work commences. 3. Where cornices are lathed on brackets, measure ceiling and walls to the edge of the brackets only. 4. Where cornices are not bracketed, measure the ceiling full size of room, and the walls up to ceiling; all in superficial yards. 5. Deduct all openings 100 square feet and over; deduct materials and add labor (hollows) for net sizes of doors, windows, fireplaces, and other openings under 100 feet superficial. 6. Where ceilings are panelled and coffered, or coved, girth round all portions that are lathed, keeping circular work separate. 7. Ceilings plastered between spars, etc., to be measured across the spars and purlins, and even then kept separate, and described as such. 8. All work run with a mould to be measured lineal on the wall and the girth given, as cornices, rustics, strings, architraves, soffits, quirks, etc.; count all mitres, with the girth of mould they belong to; count mitres in panelled work. 9. All cornices, etc., lathed on brackets to be kept separate, and described as such. 10. All cast work to be counted, except running enrichments. 11. Enriched members to be measured lineal, with girth. 12. Modelling of enrichments to be, if special, so stated, and the models to be the property of the architect. 13. Ceilings or walls covered with panels, formed by small moulds, to be measured superficial, with illustration or drawing, for "extra price over plain work;" larger panelling or special decorative features to be measured in detail. 14. Angles to pilasters, etc., if specially formed in cement or otherwise, to be so measured, lineal and extra to plastering. 15. Door and window frames, bedding, and pointing, to be counted, and state material to be used; also flushing to inside of frames after fixing, or behind casings, window-backs, or other work to be given. 16. Marking goods generally, and after plumber, gasfitter, bell-hanger, etc., and chimneypieces, as an item, stating numbers. 17. Coloring and whitewashing walls, etc., to be in superficial

yards, measuring over all openings under 100 superficial feet; if the work has to be pointed by the plasterer, state so. 18. Painting to include stopping and knotting, and to be given in square yards. Priming to be separate, if on work painted before being fixed. Painting to be girthed round all exposed surfaces, except as below. 19. Balusters, if ordinary square, and grids, gates, and other metal-work painted on both sides, with bars about five inches to six inches apart, to be measured one surface only; if closer or slightly ornamental, one and one-half surfaces; and for very close or very ornamental work, two to two and one-half surfaces. 20. Windows to be measured each surface over full size of opening for painting frame and sheets, or else the frames counted, and the sheets, if large squares, counted; but if in small squares (as old-fashioned crown-glazing), then count the squares instead of the sheets. 21. Fancy or ornamental painting to be measured in detail, with lengths of mouldings picked out, gilt, etc. All work in parti-colors to be kept separate from plain work.

PLUMBER AND GLAZIER.

1. The lead to be reduced to weight, and the different kinds of work kept separate, as gutters, flashings, valleys, and ridges, and flats; the work requiring solder, as cisterns and cesspools, dressing over finials, and other fancy work; allow proper lap, as specified, to flashings, drips and rolls; the net quantity of lead, as fixed, only to be measured. 2. All water-supply, service, waste, or other pipes, to be given in lineal feet, with the weight per foot or thickness; the dimensions stated to mean in all cases, whether specified or not, the clear internal bore. The price to include all soldering and forming joints, wall-hooks, and fixing. 3. No allowance to be measured for sockets and joints in iron-piping, down-spouts, etc.; but state whether flanges or holdfasts are to be included. 4. If pipes are to be laid in trenches in the ground, state so, and how, and whether plumber is to do the excavator's work. 5. Count all traps, and also all bends and shoes to down-spouts or soil-pipes, spitters from cesspools to spouts, rain-water heads, taps, plugs, overflows, wastes with plug and washer, water-closet, and bath fittings (the pipes thereto and therefrom measured with the other piping), wash-basins, urinals, hot-water cisterns, and other special fittings, and in all such instances to give a clear, unmistakable description of what is required, or the price, exclusive of fixing. 6. Iron-gutters and down-pipes to be measured in lineal yards; no allowance for joints, but elbows, stopped-ends, etc., to be counted and described. 7. The different descriptions of glass, with thickness or weight per foot, to be given in superficial feet, assorting each into different average sizes, and keeping bent sheets separate. Curved or other special edges to be measured lineal, the glass being first measured the size such special shape has to be cut from. Special descriptions of work, such as lead-lights, etc., to be described. 8. Pointing to flashings to be measured lineal and described. 9. Making good and leaving all perfect at conclusion of works, as an item.

IRONFOUNDER.

1. The most suitable method is to reduce each description of work to weight, keeping columns separate from beams, small castings from large, and intricate ones, as railing, grids, etc., separate from plain ones; the cost to include pattern making; any fancy work to be specially mentioned, and the castings from each such pattern kept separate from others; the metal to be taken at 40 pounds per foot superficial, one-inch thick. 2. State whether price to include fixing. (*Vide* No. 45 in Carpenter). 3. Special labor, as turning columns, coupling boxes, etc., to be given in detail. 4. State whether beams are to be tested, and if at contractor's expense and risk. 5. Bolts and other small fittings to be counted and described, with the labor necessary in preparing for and fixing them. 6. State whether lead or other material is to be found for running lugs, etc., and indicate the number of them. 7. Long-bolts, tie-rods, etc., to be measured lineal, with allowance for head and nut, and count the number of nuts, and screwing, and washers. 8. Swing-sheets, gates, etc., and their fittings, hangings, and fastenings to be fully described and counted, both for materials and labor. 9. In measuring wrought-iron beams and frame-work, ascertain the weight of metal in plates and other shapes, adding the rivets and bolts, with the labor separate on any particular forgings or cuttings. 10. All wrought-iron rolled or built girders to be fully described and given in lineal lengths, with section. 11. If painted before fixing, to be measured in full.

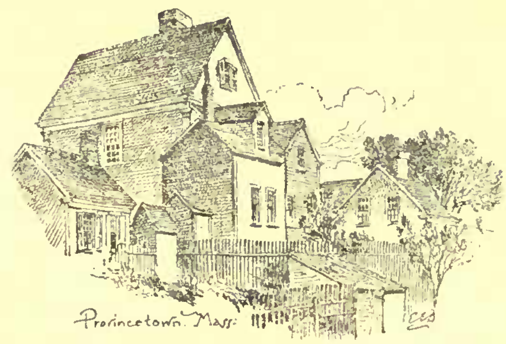
SLATER AND TILER.

1. State size and description of slates or tiles, nails, and battens, and whether and how pointed underneath, and amount of lap. 2. The usage varying with respect to allowances at eaves for double course, and hips and valleys for waste, the Manchester Society of Architects purposes to measure slating net as finished, and to give the length of eaves for extra price of double course, and the length of each bevelled edge at hips and valleys, etc., for "single bevel cutting and waste," and also the bevel cutting where so done to land-gutters, etc. All openings of 100 feet to be deducted entirely, and any others, but allowing for labor as "hollows," below that amount down to six feet superficial, below which no deductions to be made. Any special cutting, as close hips, etc., to be separately mentioned and described. 3. In tile-roofs, hips and valleys to be measured lineal, and fitting included. 4. Ridge-tiling to be fully described and given in lineal yards, and state how to be bedded and pointed. 5. Pointing to overhanging eaves or gables, in lineal feet. 6. Sweeping and cleaning out gutters, leaving all clean and perfect. 7. Circular slating, fancy courses, slating to spires, or other special work, to be kept separate and fully described.

SUNDRIES.

Floor or wall tiling, paper-hanging, cooking and heating apparatus, bell-hanging and gasfitting, are generally matters of separate arrangement with the tradesmen. If requisite to include the two latter, bell-hanging may be given at so many bells with one pull, and so many with two, the furniture being described and counted; gasfitting at so much per position, exclusive of meter, for piping and brass bits, or else measured in detail as for waterpiping.

COUNTERFEIT "ANTIQUE" FURNITURE.



TRUQUAGE, although a term probably unfamiliar to many readers, nevertheless deserves to rank among the finer arts of modern civilization, such is the ingenuity, industry and skill with which it is carried out. Burns' cotter mother was chiefly admirable for the skill with which she "gar'd auld things look maist as weel as new;" but the *truqueur* devotes himself, on the contrary, to the art of making new things look quite as good as old. The stock in trade of the French *truqueur* and his English congener, quite as expert as he, need not be large. Walnut juice, which gives an agreeable mellowness of tone, and nitric acid are neither of them expensive. The latter imitates pretty closely the ravages of ants, and holes bored with a fine auger easily give the worm-eaten appearance which appeals to the lover of the antique in carved furniture. A correspondent was informed by a workman's wife that her husband was one of those solely employed in the boring or auger business; but in Paris live worms are kept to do the work, and do it better and to order, which is more surprising. New oak can be stained by a solution of old iron in hot vinegar, which darkens it to a deeper tone; it is then carefully oiled and polished. The price demanded is such that bargains can be boasted of by the inexperienced, while really fine work always commands its value in the open market.

Any of the pieces of furniture which have to date from the sixteenth century are severely beaten with a heavy bludgeon, which serves to give them the worn appearance necessary to three centuries of existence. A common device is to paint the panels of cupboards, roughly carved on the premises, with white paint; they are then dried in the sun, and after keeping some months are washed in potash, which removes the paint in patches, and the exquisite finish of the carving beneath is apt to be taken for granted by the buyer, who is aware that in the last century much good paneling was thus painted and preserved to our generation in consequence in all its pristine freshness of cutting and outline. Buhl of a very ordinary description is ornamented by French dealers with brass scroll-work after the design of Gillott, who succeeded Buhl. In porcelain and faïence one can only say, "*Caveat emptor*," so clever are the tricks by which even the learned are deceived. At Cage's manufactory at Versailles the *faïence de Nevers* is reproduced to perfection; but here all is fair and open dealing. If the buyer prefers his purchase "antique," Mr. Cage will bake it for him until the glaze crackles; it is further mellowed in a manure heap, and a slight extra charge is imposed. The special marks of favorite potters are easily imitated, and as much pains is taken with the spurious ware with intent to deceive as would suffice to give value to real specimens. The character of the early decoration is carefully preserved, the even white of the Moustiers ware, the dead, dull white of the Marseilles and the careful finish of the old Delft potters.

At Venice the reproduction of the old palatial furniture is a thriving industry, and the same at Florence; but it possesses little or no artistic value. The ebony is black-stained wood; the *stipi* are bone, and not ivory; the shapes and patterns are carefully copied, and the prices are not excessive. Good patterns are a distinct gain in furniture; but the modern productions will not have the lasting qualities of the old. Ivory triptychs are manufactured at Versailles. The golden tint is gained by boiling in oil, then plunging into boiling water, and drying before a hot fire which cracks the ivory to perfection. These require a very skilled eye to detect, as the carving is often meritorious. Even works of the highest art do not escape the *truqueur*. Clodion, the late eminent French sculptor, discovered a group bearing his signature that had been sold for 4,500 francs. Legal proceedings were instituted accordingly. It was brought to light that the work in question was due to one Lebroc, who had made it his study to imitate Clodion. Nevertheless, three eminent judges,

Millet, Chapu and Guillaume, after careful examination and in spite of the signature, decided that in their opinion it was not the handling of Clodion. So the sales were annulled, and damages were not allowed by the courts. Clodion's real name was Michel and some of his earliest and finest works are thus signed. The famous *vernis Martin* can still be bought at Paris, very like the old, but still not genuine; and at present the secret of the real *Martin vernis* remains as impenetrable as ever.

In buying old oak furniture the buyer should notice the presence or absence of the "ties" or cross-bars near the floor, which are invariable in the construction of the seventeenth-century joiners. The forger is apt to forget this and thus himself brand the work as spurious. Decoration was formerly the proper art of a guild of Florentine artists in the fourteenth century. Painters, jewelers, engravers and metal-workers lived in a happy state of co-operative harmony, so that a coffer or casket might bear the successive impress of many clever hands, as the enamel, the setting, the lock, the jewel-work, would each be executed by an artist craftsman skilled as Dello, or Cellini, or Ghiberti. — *Lumber World.*

NOTES AND CLIPPINGS

Limewood for Carving. — The old Dutch carvers, of whom Grinling Gibbons was the acknowledged head, largely wrought in limewood, and, as this wood is not free from the attack of worms, a great part of this old work has been destroyed, or has had to undergo preservative processes, details of which will be found in T. A. Britton's "*A Treatise of Dry Rot in Timber.*"

Purgatory in a Cock Loft. — The old Dominican church at Nice, known as St. Dominic, is now used as a bakery for the French army. A few days ago, when the architect was employed to make some examination of the roof, he discovered in the garrets over 600 skeletons that had been flung in without order or arrangement. The medical experts declare they must have been buried in the church three or four centuries ago. When Nice was occupied by the French soldiers in 1792 the monks were driven out of the church, which was used for military purposes, and it is supposed that in making certain changes in the floor the skeletons were thrown up in the garrets. The majority of the bones are those of women, and among them there is no doubt the skeleton of a Duchess of Savoy, who was buried in the church. All the remains have since been buried in one of the cemeteries of Nice. — *Exchange.*

Increasing the Hardness of Bricks.— For obtaining products that will offer greater resistance to humidity, etc., than ordinarily is the case, an improved process of manufacturing bricks has been brought forward in Germany. After drying and grinding the clay, a mixture is made of 91½ parts of the latter, 3 parts of iron-filings, 2 of table salt, 1½ of potash, and 2 of elder or willow wood ashes. The whole is heated to a temperature varying from 3362° to 3632° Fahrenheit; at the end of from 4 to 5 hours the argillaceous mixture is run into molds, then rebaked in the ovens — always protected from the air — at a temperature of 842° to 932° Fahrenheit. The product may be variously colored by adding to the above quantity 2 parts of manganese for a violet-brown, 1 part of manganese for a violet, 1 part of copper ashes for a green, 1 part arsenite of cobalt for a blue, 2 parts of antimony for yellow, and 1½ parts arsenic and 1 part oxide of tin for white.— *Exchange.*

Some Facts about Redwood. — The producers of redwood lumber are just beginning to understand a fact in regard to the Eastern requirement that is of vital importance to them as far as building up a permanent trade with the East is concerned, which is that their lumber is sawed too thin. The mills in the redwood districts aim to saw just one inch in thickness. The allowance made for surfacing is three thirty-seconds of an inch for each cut, so when surfaced on two sides the lumber is three-sixteenths less than an inch, whereas, the rule in Chicago and other markets is that lumber, whether dressed on one or two sides, must be full seven-eighths of an inch thick. The reason why the thin lumber will not answer is that when used with other kinds of lumber it will not match. Moreover, in house-finish, some of it is to be dressed on one side and some on two; but the two are worked into the same job, and therefore redwood is not consistent with itself. The difficulty is the same with one and one-fourth inch and one and one-half inch; but two inch and over is all right, as the allowance made here is greater on the thick. Another thing the Westerners should understand is the penchant that consumers here have for bright and fresh-looking lumber. For that reason the pine wholesalers never dress their lumber until it is shipped. In California, however, lumber is dressed on one side as it comes from the saw: it is then piled and allowed to dry, and by the time it is ready to ship the old dressing makes a sharp contrast with a fresh surface, if the order happens to call for lumber dressed two sides. As finishing-lumber is used the best side out, and as either the old or freshly-dressed side may contain imperfections, the result is a variegated appearance which is not desirable In fact, the freshly-dressed surface determines the character of the stuff, whether good or cull, and the chance for selection is destroyed. In another point the green-dressed surface is at a disadvantage. In drying there is a more or less unequal shrinkage of the fibres, so that the grain of the wood is marked in little ridges, and the same result is reached as would be by poor surfacing. The evidence all goes to show that the redwood men should allow their lumber to dry before dressing. — *Northwestern Lumberman.*

An Obsidian Mountain.— One of the forthcoming reports of the Geological Survey will contain a paper by Professor Joseph P. Iddings upon an obsidian cliff in Yellowstone Park. This cliff is an elevation half a mile long by from 150 to 200 feet high, the material of which, Professor Iddings says, "is as good a glass as any artificially manufactured." Its colors and structure not only make it highly interesting to the visitor, but furnish to the scientific investigator phenomena of importance. The cliff presents part of a section of surface flow of obsidian, which poured down an ancient slope from the plateau lying east. It is impossible to determine what the original thickness of this flow was. The dense glass which now forms its lower portion is from 75 to 100 feet thick, while the porous and pumiceous upper portion has suffered from ages of erosion and glacial action. A remarkable feature of the cliff is the development of prismatic columns, which form its southern extremity. These are of shining black obsidian, rising from the talus slope, and are from 50 to 60 feet in height, with diameters varying from 2 to 4 feet. The color of the material of this cliff is, for the most part, jet black, but much of it is mottled and streaked with bright brownish-red and various shades of brown, from dark to light yellowish, purplish and olive green. The brilliant lustre of the rock and the strong contrasts of color with the black are very striking. In places the glass, in the process of cooling, has been broken into small angular pieces, which have been again cemented by the later flow, producing many colored and beautiful breccias. In some places the material shows a fine satin lustre, while in others a deep golden sheen is noticeable, which, under the lens, resolves itself into thin beams of red and yellow light. Through the black and red glass are scattered dull bluish-gray patches and bands, and round gray and pink masses, the effect of which is to still further vary the appearance and beauty of the rock, and make it the most conspicuous and characteristic variety of volcanic lava known.

TRADE SURVEYS

In almost every industry, and in every commercial channel, there is a marked increase in business, during this fourth quarter of the year, as far as it has gone, over the same time last year. The increase ranges from ten to twenty-five per cent. The improvement does not show itself very fully in the ordinary statistics relied upon. Yet there is a vast improvement in every direction. For several weeks this expanding volume of business was not followed by a corresponding improvement in prices. An improvement in this respect has at last set in. It was heralded by announcements in trade journals of advances before actual advances had taken place. The shrewder industrial managers early took alarm, and placed enormous orders for material, and thus laid the foundation for the present improvement. The full scope of the improvement is not apparent, because manufacturers, railroad-managers, and others are devoting most of their improving margins and not a little of new capital to the expansion of facilities of one kind or another, and of productive capacity. The railroad companies are especially following this policy. All of the trunk lines are making improvements, extensions, and additions of one kind or another. The Western and Southern railroad companies are spending more money in rails, lumber, cars, locomotives, terminal facilities and feeders than was ever expended in the same time before. The iron and steel makers are increasing their manufacturing capacity, but they did not begin this policy until after orders began to accumulate at a surprising rate. As compared to six months ago, prices are higher in all the great industries. On as much as one-fourth of our railway system freight-rates have been increased, not on all classes, however. Railway-managers contemplate a general increase of freight rates, as business expands. The textile manufacturers have permitted themselves to be led into large contracts for winter and spring delivery on the basis of low fall quotations, but most of them are now insisting upon an advance of from ten to twenty per cent on spring deliveries. Jobbers everywhere are quietly quoting higher prices, convinced that it is not only necessary from a mere business standpoint, but necessary in order to prevent a rushing in of orders of a speculative character. Consumers of all kinds of material for manufacturing, railroad, and building operations, are ready to take advantage of opportunities for covering spring and later requirements. The present advance has induced them to delay the placing of orders which would go very far to create a booming tendency in the market. This is one serious danger which we have just passed through, or rather, through which we are passing safely. Within six months from this time the producing-capacity of the country will have been largely increased in a variety of directions, and the necessity for an advance in prices will have been thereby largely overcome. During the past thirty days contracts have been placed for no less than one hundred thousand tons of steel rails, for immense supplies of brick, lath, shingles, lumber of all kinds, for cars, locomotive-engines, and stationary-engines of all degrees and capacity. For all kinds of building-material, builder's hardware, and for steam and electrical machinery. Meanwhile trade combinations have been perfected, manufacturers of machinery, of textile goods, of hardware, of pipes and tubes, of agricultural implements, and in some other branches, have come together and have perfected their trade organizations in the East and West by which their mutual interest can be more efficiently subserved. There is a scarcity of freight cars on most roads, and of coal cars on all of the lines largely handling that fuel. There is an upward tendency in prices which is stimulating confidence in trade and commerce. The development of industrial activity in the South shows no abatement. A presumably correct statement of the last nine months' progress in fourteen Southern States gives the investment of $84,000,000, in round numbers, in a multitude of small industries; besides this, large sums have been invested in railway construction. Our latest advices from Great Britain go to show that the worst is over. One leading iron-master said recently that it would not be very long before the demand for hematite ore would go beyond the capability of that country or any other. The industrial depression in Great Britain seems to be steadily dying out. Confidence is being reëstablished. This condition of things will react favorably upon the industries of the United States. The labor question will become less and less troublesome, notwithstanding the apprehensions of employers and that class of minds which do not recognize that labor has a right to think. The growth of power will be accompanied by a wiser use of it. Strikes will diminish in number, and lockouts will be resorted to only in the extremest cases.

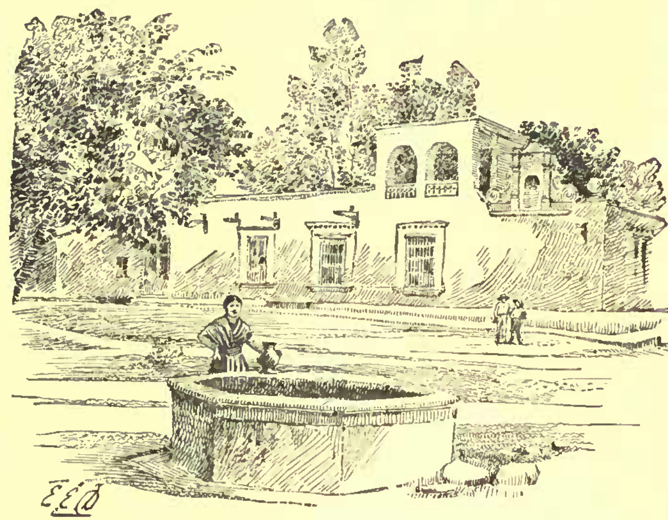


Brick, Kiln. Tacubaya.





The Fountain. Texcoco.

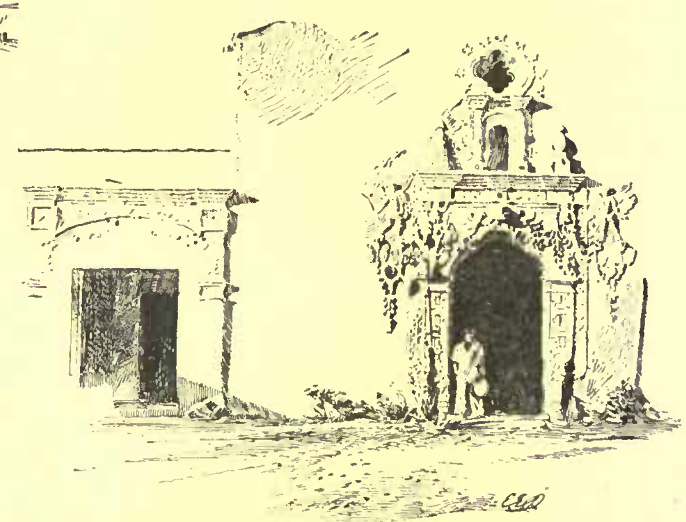




At Guanajuata.



Aqueduct. La Labor, Sonora.



Chapel Doorway. Texcoco.

MEXICAN SKETCHES.

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CONTENTS

ONE of the matters which we hope will engage the attention of the Convention of the American Institute of Architects is the provision of better and cheaper facilities for the conveyance of drawings by mail. At present, by a ruling of the Postmaster-General, drawings and tracings must pay letter postage, and where drawings are sent in pasteboard cylinders, or on wooden rolls, as is absolutely necessary to preserve them from the rough handling of the letter-carriers in cities, the cost of forwarding them by mail, although only one-half of what it was last year, is still very considerable, especially as compared with that of sending parcels of merchandise or printed matter; and architects are in consequence usually obliged to entrust their plans to the express companies, which, in country towns, are apt to be slow and uncertain in delivery. Even where an architect, for the sake of having his drawings transmitted through the most direct and recognized channel, goes to the expense of sending them by mail, he is, under the present system, by no means sure that they will arrive safely, and he has no redress against the Government in case of their loss or destruction. Most of us have had repeated experience of the loss of plans in the mails, and we remember one occurrence, more annoying, if possible, than the total loss of such property, where a city letter-carrier, to save himself the trouble of taking upstairs a valuable plan, which, unfortunately, had not been rolled on a cylinder, deliberately crumpled it up and pounded it until he could force it through a half-inch slit into a little letter-box in the hall-way of the building where he was to deliver it, and there it was discovered, some weeks later, after a great deal of time had been spent in trying to find what had become of it. Our post-office system is none too good, in any case, but we rarely hear of losses of merchant's samples, or other things of the kind, which pay for transportation only a small fraction of the tax levied on architects' drawings, and so long as architects pay exorbitant rates for such service, they are certainly entitled to demand that it should be done with decent care and despatch. The fact is that in the whole matter of transmission of parcels our post-office is at least twenty years behind that of any other civilized country. In England, France or Germany it is now as common to take a box or parcel to the post-office for forwarding as it is with us to mail a letter. Anything, not dangerous to other property carried with it, is accepted, prepaid by stamps at what seems to us an absurdly low rate, and sent by the next mail, and delivered to the consignee. There is a limit to the size of the parcels received, but in England, anything can be sent, we believe, which does not exceed seventy pounds in weight, or which does not measure, by adding the length to the girth, more than six feet. As these limitations admit a trunk of tolerable size, nearly all the transportation for private individuals which with us is done by the express companies, inconveniently and expensively, is there carried on by mail, and the service is so efficient and profitable, even at the low rates charged, that the various European countries are at this moment actively engaged in arranging for the extension of the "parcel post" to include service from one country to another. Here, as each nation has its own custom-house regulations, it is necessary to provide for examination at the frontier, and for the collection of the duties, but this has been successfully arranged, and the international parcel post is already in operation between England and Belgium, and will, according to the official announcement made last summer, be very soon extended to Germany and Holland, if it has not been already established. Between England and her colonies packages of merchandise have been transmitted by mail for some months, at rates which must make Americans who do not own stock in express companies rather envious. The last parcel which came to us across the ocean was a box, about fourteen inches cube, containing some books, and the bill for transportation from Liverpool was about five dollars. The same parcel, if we understood correctly the tariff of rates of the Colonial parcel post, which we saw in various places in England, would be carried from any post-office in England to any post-office in New Zealand, and delivered to the consignee, for thirty cents. Now, New Zealand is exactly on the opposite side of the earth from London, and the distance, by the shortest mail route, is about fourteen thousand miles, and if the English mail-steamers are glad to carry such a box fourteen thousand miles for thirty cents, it would seem as if a charge of five dollars for conveying a similar box, in the same steamer, less than one-fourth of the distance, must allow, to say the least, a considerable margin of profit. In a less degree the same discrepancy in cost between having a thing done on a great scale for the public benefit, and on a small scale for private profit is to be observed in inland transportation, and it is quite time that the people in this country out of whose pockets comes the difference should have the benefit of such economies as are now in operation elsewhere. Although architects do not have to pay out a very large portion of their substance for the carriage of their plans, their express and postage bills generally amount to a very respectable sum by the end of each year, and as they have the advantage of being able to speak their minds through the deliberations of a highly-respected organization, representing all portions of the country, whatever they might say on the subject would be sure to command attention.

THE State of Maine has recently established a Board of Health, which, to judge from its first Annual Report, vies in zeal with any board of the kind in existence. When we say that among the subjects treated of in the first report are small-pox, vaccination, cholera, yellow fever, scarlet fever, diphtheria, contagion, typhoid fever and consumption, it will be seen that the Board does not propose to lose any of its fellow-citizens during the year through its want of faithfulness in providing preventive suggestions against disease, and it must feel a comfortable consciousness of having covered the ground of contagious maladies pretty thoroughly. In general, the essays on these and the other principal topics are necessarily similar to those which appear in other reports of the kind, but the Maine Board has, besides these, collected a great number of reports from medical correspondents all over the State, which are extremely interesting, and in many cases valuable. There are few better observers to be found anywhere than country physicians. Thanks to the laws regulating medical practice, and to the many excellent professional schools in this country, one is sure to find in every village at least one careful and experienced man, fortified by his scientific training against hasty theorizing or one-sided observations, sufficiently versed in modern sanitation to write intelligently on the subjects to which it relates, and intimate, as only a good physician can be, with the methods of life of those among whom he dwells. It would hardly be possible to imagine a better or more trustworthy source of information than the experience of these men, and the Maine Board of Health, in the long series of little reports which it gives, offers hardly more than a suggestion of the benefits which sanitary science is some time to derive from such sources.

MANY curious quotations might be made from the letters of the Maine doctors. According to their unanimous testimony, consumption of the lungs is the most prevalent serious disease in the State, and many of them seem to have devoted an unusual amount of time to the study of the circumstances under which it arises. Among these, most believe that inheritance is the principal predisposing cause, but next to this nearly all put bad ventilation and dampness. One physician believes that, next to hereditary influence, the breathing of vitiated air at night is the most potent cause of consumption. He acknowledges that "the bad air of school-houses may have something to do with causing it, but not one-tenth as much as that of close sleeping-rooms." Most of the others, however, are inclined to attribute worse effects to school-room air than to that of bed-rooms. Even one who says that "heredity is the principal cause" of consumption in his town, remarks in the next sentence that "the most serious troubles with the schools are poor ventilation of the buildings, and dampness of the soil under and around them," and many, with reason, as it would seem, ascribe rather to the damp, ill-aired and often filthy school-houses, in which children pass their days, at least the depression of the vital forces which provides easy victims for the inherited or communicated disease, which in most cases makes its attack either during the period of school life or soon afterward. It would take too much space to quote half the interesting observations made in these letters, and the almost unanimous testimony which they contain to the wretched condition of the Maine school-houses would be best left for the private consideration of the citizens of that State, so we will finish by mentioning only a curious case, in which two young girls came on the same day to consult a certain physician about what seemed to be pulmonary trouble. Both appeared to have the same symptoms, which were those of incipient consumption, and subsequent visits only confirmed the impression made by the first. The doctor, as it happened, was provided with a good microscope, and finally examined with this the matter expectorated by each patient. In one case the matter was found to be swarming with the rod-like bacilli, while in the other case they were altogether absent. On being urged to give his opinion in regard to his patients, the doctor predicted that the latter would recover, and in a few weeks the inflammation of the lungs had run its course, and the girl was as well as ever; while the other patient grew steadily worse, and died in a few months of consumption.

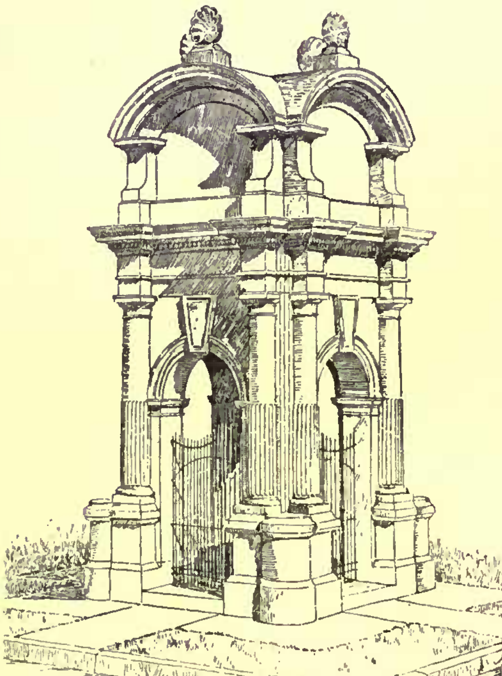
THE *Sanitary News*, with its customary energy, has been devoting its attention to the sanitary condition, or rather, prospects, of the Indiana State Capitol, and has been put in possession of some curious facts. Fortunately for their fellow-citizens, the people in Indiana who know something about building do not hesitate to inquire whether the huge structure for which they pay is being properly constructed, or to speak their minds if they find anything going wrong; and in the same way, at a meeting of county health officers, held some months ago, it was voted to investigate the plumbing and drainage of the building, which was suspected not to be quite what it should be, with the view of calling the attention of the Capitol Commissioners to anything that might be found objectionable. The investigation resulted in showing that a brick sewer, four feet in diameter, passed directly under the building; that it received on its way the various waste-pipes from the rooms above, all of which were, for a portion of their length, of glazed earthenware, imperfectly jointed, and buried under the cellar floor, while the remaining portion was of iron, jointed with hydraulic cement into the glazed pipes; that two of the soil-pipes were vented into brick flues, one of which had an opening into the attic; that no back-vents were provided to the traps of urinals or wash-stands; that there was no fresh-air inlet to any of the soil-pipes; and that the waste-pipes were too large, the urinals, for instance, being provided with four-inch outlets. The Commissioners were duly notified of these variations from the principles of house-drainage now current, but, instead of being grateful for the correction, they replied by asserting that "the plumbing had been arranged in accordance with the cardinal requirements of perfect house-drainage," and that they had employed a sanitary engineer "of national reputation," Mr. Levi R. Greene, of Boston, who had "made plans and specifications for plumbing in state-houses, hospitals, penal institutions and hotels in various parts of the country," and that this gentleman had pronounced the arrangement "altogether satisfactory and successful." Fortified by this opinion from their renowned expert, it is hardly necessary to say that the Commissioners paid no further attention to the investigating doctors, who were reduced to console themselves by describing their case to the Conference of State Boards of Health, which met at Toronto not long ago. Of course the Conference agreed entirely with the medical men, and commended their public spirit in endeavoring to have the State-House drainage made to conform with the present practice of intelligent engineers, but that, we suppose, will be the end of the matter, and the Indiana Capitol, that monument to a cheap architect, its ruined contractor, and an expert who, if the Commissioners represent him correctly, may at least be called old-fashioned, will finish, like so many others of the public buildings which discredit this rich and intelligent country, by quietly poisoning the people who pay for it, until, years hence, the public discontent makes it necessary to overhaul and reconstruct two-thirds of the plumbing, at immense inconvenience to the occupants of the building, and at a cost far exceeding that of the most perfect arrangement, put in at the proper time.

THE Grand Prize in Architecture at the French School of Fine Arts, has been awarded this year to M. Defrasse, pupil of M. André. The second place was awarded to M. Louvet and Ginain, and the third to M. Sortais, pupil of MM. Daumet and Giraud. It is worth remarking that M. André, whose pupils receive a large proportion of the recompenses in the School of Fine Arts, was the master of our own lamented Richardson, who enjoyed for about seven years his counsel and instruction. The subject for the prize design was a court-house, on a grand scale, the programme calling for a large central hall, the *Salle des Pas Perdus* of the French and Belgian court-houses, around which were to be grouped four small court-rooms, and a large public hall, for the announcement of decisions of special interest, while a hundred or more offices and consultation-rooms were to be accommodated in specified portions of the building, and a storehouse for records was to be designed in close connection with it. M. Rivoalen, who contributes to *La Semaine des Constructeurs* an interesting review of the prize works, compliments highly several of them, dwelling particularly upon the plans, which always seem to a French architect the most important portion of a design.

THE *Deutsche Bauzeitung* describes an absurdly simple piece of machinery, which, for all its simplicity, might often be made of great use, especially on those occasions when ingenuity is required to make the most out of ordinary materials. In this case the object to be attained is the dragging of a heavy weight up an incline, and the materials necessary consist of one long stick, one short one, one long rope, and one short one, and a handspike or bar of any sort. The apparatus is put together by sharpening the long stick, and thrusting it two or three feet deep into the ground, somewhere near the upper part of the hill. It is best to incline the pole away from the object to be hoisted. The short rope is then fixed at one end, by a loop, to the top of the pole, and at the other end to the short stick, which is driven into the ground on the side of the long pole opposite to the direction of the object to be dragged up the hill. One end of the long rope is finally turned once or twice around the pole, near the ground, and knotted over the handspike, and the other end is carried down the hill and attached to the load to be hoisted. If the top and bottom of the pole have been previously well rounded, it can readily be turned by the handspike, winding up the rope, and pulling the load up the hill. Almost any amount of power can be obtained by lengthening the handspike, and if the machine should give way by the pole being dragged out of the ground, it is the work of a few minutes to set it again in another place. It is hardly likely that such a rude device would supersede entirely the windlass or capstan, but for such purposes as helping a tired horse up a hill, or pulling an overturned vehicle out of a ditch, where nothing but improvised machinery can be had, it is admirably adapted.

AS the building-season for the current year has practically closed, so far as the beginning of new structures is concerned, we can accommodate in our Saturday's issue the most important of the building items we usually publish, and hence the publication of the mid-week number will, for the present, be suspended.

ARCHITECT, BUILDER AND OWNER BEFORE THE LAW. — I.



The Pilgrim Rock, Plymouth, Mass.

THERE is an old proverb, that "he who undertakes to be his own lawyer has a fool for his client"; and if one who essays to be his own architect usually purchases at a very high price a very imperfect knowledge of some portion of the art of building, the man who imagines that by reading a few law-books he will be enabled to get the better of his less instructed fellow-citizens is likely to have his illusion removed still more suddenly and unceremoniously. Nevertheless, as by knowing something of the art of construction persons of intelligence are led to greater respect for those who devote their lives to the study and practice of that art, and, by understanding their counsels better, derive greater benefit from their services, so may a layman, by knowing something of the legal rights and responsibilities which belong to his position, be enabled to avoid the misunderstandings which lie at the bottom of nearly all business disputes, at the same time that he is forewarned against the errors by which he will incur the penalties of neglect of duty, and fortified, if necessary, in his endeavors to resist intentional fraud, or to enforce just claims. Among all the business relations which men enter into, there are none, perhaps, more complex than those which are involved in the construction of a building, by the coöperation of a multitude of contractors, journeymen, and dealers in materials, under the supervision of an architect, for the owner of the land on which the building is erected, who is also the employer of the architect; and it speaks more for the general honesty and good faith with which such operations are carried on than for the prudence of the persons who engage in them that there are hardly any two classes of men whose legal status, in regard to other people, is so undefined as that of architects and builders.

Of these, the architects seem to have had the least occasion to appeal to the law in defence of their rights. Perhaps a million building contracts, taking the world over, are carried into execution every year, and it would be strange if, out of all these, disputes enough should not arise to make the list of building cases decided in the courts a tolerably long one; but architects are not only less extensively employed than builders, but appear to be even more peacefully inclined, and cases to which architects are parties are rare. For this reason, much that relates to the legal position of architects must, for want of judicial decisions bearing precisely on the point, be inferred, or at least illustrated, by the comparison of cases belonging to the history of somewhat similar professions, yet, scanty as is the material for fixing his exact relations to other persons, the architect is so important a factor in building contracts carried out under his care that it is best to begin by defining those relations as carefully as circumstances will allow, taking up first the mutual duties and obligations of the architect and his client, the owner of the future building, and afterwards those which exist, or may, under certain conditions arise, between the architect and the builder.

An architect may be employed in two different ways to render professional services. He may be hired, at a given salary, payable by the day, or week, or month, or year, to perform certain duties, or he may be simply engaged to do a certain piece of work, either for a fixed sum, expressed or implied, or, as is more usual, for a small percentage on the cost of the construction carried out under his charge. His engagement to render service in either of these ways forms the subject of a contract between him and his employer, and as it is upon this contract that he must rely for obtaining his compensation, he cannot be too careful to have the terms of the agreement clearly understood by both parties. In consideration of the liability of the human memory to error, and to prevent innocent persons from being imposed upon by people professing to have claims against them, founded on long-forgotten conversations, the laws of all civilized countries provide that no court shall recognize, or assist in enforcing, any agreement for services which are not to be performed within one year from the time of the making of the agreement, unless the agreement, or some memorandum of it, shall be in writing, signed by "the party to be charged," that is, by the one from whom payment is sought. This rule is strictly applied in the case of hiring salaried employés, and when a man is, let us say, appointed city architect, or engaged as assistant engineer, "for one year from the first of next month," or "for twelve months from the beginning of the next financial year," he may be dismissed, without fault on his part, at any time before the expiration of that period, and will be without redress, unless he can show a contract, or a memorandum of his appointment, or some other unmistakable evidence of the terms of the understanding between him and his employer, expressed in writing, and signed, in some manner satisfactory to the court, either by the employer or by an authorized representative. There are many instances of the application of this rule, which is one of the sections of the Statute of Frauds, and appears, in nearly the same words, in the statute-books of all our States, as well as in those of other countries; but one or two illustrations will be enough. In a certain case a land-owner, on the twentieth of July, hired a steward, agreeing verbally to employ him for a year, but allowing him a few days to make arrangements for his change of place. The steward entered upon his duties on the twenty-fourth of July, and afterwards found occasion to call upon his master to perform his part of the agreement, but failed, the court holding that the contract of hiring was void under the Statute of Frauds, for want of writing. So where a journeyman wagon-builder[1] verbally agreed to work two years for a certain firm, for which he was to receive one hundred dollars, or fifty dollars a year, and, after working for them six months, became tired of his bargain, and left them, it was held, when his employers sued him for breach of contract, that the agreement, not being in writing, was void under the Statute of Frauds. It is worth noticing, however, that it seems to have been the condition that the agreement was to be for two years, for one hundred dollars for the term, which brought it unmistakably within the statute, and if the contract had been, let us say, for services for two years at a dollar a week, there appears to be some doubt whether it might not have been enforced, although not attested by any written paper. In the discussion of the same case before the Supreme Court of the State of New York, reference was made to another,[2] in which the defendant had verbally promised to pay the plaintiff, a minister, a salary of two dollars a year for his services. The services were duly rendered, and the defendant, probably thinking that the minister could not bear the loss of interest on his salary so well as himself, paid him a dollar every six months, instead of waiting until the end of the year before paying him his two dollars. This went on for several years, until differences arose between the minister and the capitalist, and the former had to bring suit to have the contract fulfiled by the other party. His claim was resisted on the ground that the agreement, being for services not to be performed within a year, was void under the Statute of Frauds. The court, however, decided that in the absence of any written contract or memorandum, the fact that the minister had got his dollar every six months was evidence, the value of which might be estimated by a jury, going to show that the real intention of the parties was to have the minister do six months' work at a time, and get his pay for it as soon as he had earned it, and if the jury concluded that this was the actual intention, the Statute of Frauds was inapplicable to the contract and it might be enforced. Fortunately for the minister the jury did come to this conclusion, and he recovered the amount of his claim. It has been decided in Connecticut, also, where an engagement was made with a man to work in a

[1] Drummond *vs.* Burrell, 15 Wend., 307.
[2] Moore *vs.* Fox, 10 Johns. R., 244.

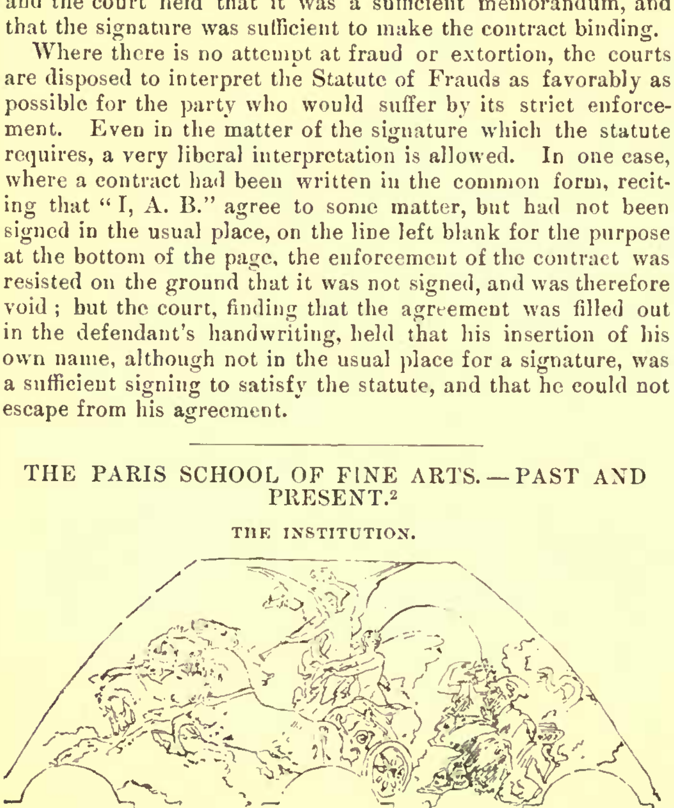
factory a year, at a dollar a day, and the agreement was afterwards repudiated, that as there was no time agreed upon for the man to begin his work, he might have begun it immediately, and as the Statute of Frauds only refers to contracts which in their nature cannot be carried out within a year, it did not apply here.

Although the courts do not assent to any evasion of the law, they will accept a written and signed memorandum, made subsequently to the verbal agreement, and intended to refer to it, as a good substitute for it, and this written memorandum may be made at any time before the contract is completed. A good example of this is to be found in a case where a verbal contract was made for the sale of some coal,[1] which was afterwards repudiated by the seller, and a suit for damages was contested on the ground that the contract was void by the Statute of Frauds. It was proved that some time after the verbal agreement of sale was made, the purchaser wrote to the agent of the defendants, asking for "a statement of our coal engagement," and received an answer, recounting the quantities and prices that had been agreed upon. This reply was signed by the agent, and the court held that it was a sufficient memorandum, and that the signature was sufficient to make the contract binding.

Where there is no attempt at fraud or extortion, the courts are disposed to interpret the Statute of Frauds as favorably as possible for the party who would suffer by its strict enforcement. Even in the matter of the signature which the statute requires, a very liberal interpretation is allowed. In one case, where a contract had been written in the common form, reciting that "I, A. B." agree to some matter, but had not been signed in the usual place, on the line left blank for the purpose at the bottom of the page, the enforcement of the contract was resisted on the ground that it was not signed, and was therefore void; but the court, finding that the agreement was filled out in the defendant's handwriting, held that his insertion of his own name, although not in the usual place for a signature, was a sufficient signing to satisfy the statute, and that he could not escape from his agreement.

THE PARIS SCHOOL OF FINE ARTS. — PAST AND PRESENT.[2]

THE INSTITUTION.



Original Sketch by Pils for a panel over the Grand Staircase of the Paris Opera-House.

WHEN Louis XIV was weeping at the death-bedside of his prime Minister Mazarin, this last told him he would not be much loss, as Colbert remained behind. This compliment was not exaggerated, as it is due to this great man and public benefactor that France to-day owes its present National Institution of the Fine Arts.

It was founded by Louis XIV in 1648, and in 1671 he added an Academy of Architecture; after a century and a quarter of existence, in 1793, the year of the Revolution, the two were suppressed, but two years later, 1795, the schools of painting, sculpture and architecture were reunited in one and given the name of School of Fine Arts, and made independent of the Academies, known as the Institute of France; and in 1819, Louis XVIII developed a system of instruction which was not interfered with until 1863, under the second empire. It was divided into two sections: painting and sculpture, and architecture. In the first department were twelve professors — seven painters and five sculptors — who came daily to the school, to explain the human figure as drawn from the antique and living model, while three of these professors had special courses in anatomy, perspective and history. In the second division of architecture the tasks were divided between four professional architects, one for theory, one for practice, one for the history of the art, and one for mathematics: while they were assisted in their decisions of the competitions of emulation by a commission of twenty honorary members selected among the most distinguished architects of the time, by the assembled professors of the school. There were a director, secretary, and five members for the actual administration, all selected yearly, among the Council. By this arrangement the school was endowed, by the decree of 1819, with great prerogatives, and controlled itself by an elected council, which taught as it saw best, without ministerial interference; but in 1863 the Imperial Government completely changed this organization, and relegated to itself the control of this most important branch of public instruction. Its argument was that the school being a national institution, the Minister of Fine Arts was held responsible for it to the Emperor, and it was not just if he were not allowed to penetrate in the councils of the school, and there impress some of his ideas for its existence, and, while admitting that a body of *savants* should be recruited among themselves by election, yet it held the School of Fine Arts was not a learned body, but a service of the State, whose management should enter into the attributions of a ministerial department, regulated and administered by the same rules and principles; while it further contended that the system of self-elective professors had, as an inevitable result, the perpetuation of doctrines and theories more or less absolute, which jarred with the principles of the Empire, which pretended to have no system or fixed and prejudiced ideas, but judged all without prevention, only too happy to encourage originality. Of course their arguments were entirely justified by every theory of Imperialism. No painting had before been taught, nor engraving on metal or gems; while in the architectural department, the classical traditions and instruction that prevailed and were insisted upon prevented any fresh and vigorous individuality from receiving encouragement or recognition.

So on the 13th of November, 1863, the Emperor signed a decree re-organizing the School of Fine Arts, in which the administration was confined to a director, named for five years, who was chief over all the subordinates, and the interpreter of the wishes and decisions of the Minister, and all his administrative regulations. The service consisted of a secretary, a treasurer, a librarian, and a keeper of the casts; the corps of instructors included seven lecturers and eleven heads of studios; while there was instituted a superior council composed of the superintendent of the fine arts, the director of the administration, two painters, two sculptors, two architects, one engraver, and five members appointed by the Minister.

A list of the studies is pertinent to the subject, as well as to give an idea of the importance of the school as a national institution of learning. For the painters, sculptors and engravers, there were the history of art, anatomy, perspective, costumes, ornament and æsthetics, and for the architects some of the above, as well as architectural history, architectural theory, building, legislation, physics, chemistry, universal history, literature, archæology, decorative composition, construction, both theoretical and practical, plain and descriptive geometry, stereotomy, and mathematics from the first principles of arithmetic to the highest branch of mechanics.

This so radical reform of the old system of artistic instruction aroused violent recriminations. The Institute of France saw with great displeasure escape from it attributes that gave it a *rôle* and considerable importance. Ingres bitterly contested the arguments of the Imperial Government, believing it tended to destroy the former good organization of the school, that it attacked rights acquired by time and respected by all, and a manner of instruction based on classical traditions, to give in return one only founded on fantasy and adventure, with incompetent judges falsely directing the studies. The newspapers were filled for weeks with protestations, though hundreds of professional men sided with the Emperor, and recognized that the liberal principles on which were based the terms of the decree, opened to young talent a new horizon, and placed the instruction within the requirements of the period and the progressive spirit of the century. As by this decree the Institute of France lost absolute control of the official instruction of art, and placed it in the hands of the Imperial Government, the forty "immortals" were not slow in announcing their opinion of the sagacity of the act, though since, they have been willing to concede that this transfer of authority was for the best interests of France and art.

THE PRIZES.

As there are over one thousand students, the school has instituted, for their encouragement and emulation, a large number of medals, while endowments have been made from time to time, until now there are twenty-six cash prizes given by the school and Institute, amounting to 32,145 francs, but the highest gift in the hands of the Government is the Grand Prize of Rome. To not mention it would be an oversight, as it is entirely conducted at the school, though the subject is given and the award made by the Institute of France. The hospitality of the school, which was offered to foreigners for the first time under Louis Philippe, was extended under the Empire, to competition for all the medals and cash prizes except this prize of Rome.

In 1666 a lull in the storm of rivalry that existed among the artists in the French Academy and its disagreements outside, was obtained chiefly by the efforts of Colbert, who asked the painters to assist him in his endeavors to raise the character of the fine arts, and no man had a better right to a respectful hearing than the Minister, who at that moment was urging the king to purchase a palace at Rome, for the reception and instruction of young prizemen, to make permanent that intercourse with Italy, which had already been frequent though desultory, for Louis XIV had, at his own cost, sent painters, sculptors and architects to Rome, for the purposes of study and comparative observation, and he now determined to recompense,

[1] Williams *vs.* Bacon, 2 Gray, 391.

[2] A paper read before the Gotham Art Students, New York, by Mr. Henry O. Avery, architect, graduate of the Paris School of Fine Arts, and Member of the New York Chapter of the American Institute of Architects.

each year, those students who carried off the royal prizes, by the establishment in Rome itself of a branch academy, in which twelve artists could be lodged and boarded at the king's cost, each for a term of five years. Such an extension of the functions of the Academy in Paris conduced to greater harmony in the conditions of its affairs and greater emulation among its members than had ever existed before. The rise and progress of the Academy at Rome has been unchecked for two centuries.

This travelling scholarship consists of a five years' residence in Rome, though the student is expected during the second year to visit the principal cities of Italy, and even go to Greece, where there is also an Academy at Athens. The list of successful students is a long one, and to give it would be but to repeat many of the greatest names that have figured in the history of European art. In the estimate of their attainments and developments, the list suggests the obvious result which systematic training in a particular line must have produced, not only on the art of France, but on the nation at large.

THE PROFESSORS.

Ingres in the first half of the century, and the celebrated and world-renowned trio, Cabanel, Gérôme and Pils, under the second empire and republic, have shaped the art of France and made its progress sure and unchangeable. Classicism culminated in Ingres, and the present generation of professors have in a great measure respected its traditions, while consecrating their time to the services of art and their country.

Ingres, born in the last part of the past century, was a pupil of David, and received under him the Grand Prize of Rome, and became the champion of his classical teachings, so much so, he was accused of searching the ideal in the past and not in the present century, but the verdict of his contemporaries and admirers was that he was so great he was eternal, and not of his time and period; he is considered the greatest draughtsman of his century; his drawings can be compared to the finest period of Italian art — they are the maximum of science in art, energetic without ostentation, precise without minutiæ, full of masculine dignity without pretension — in a word, perfection. He produced a tremendous work, by incessant labor, as he considered that incessant genius depended on the will. He was short, stout, with strong features, low forehead, broad nose, severe mouth, with a jaw of iron, and black, snappy eyes. Everything in this extraordinary man was robust, and prepared him to enter the arena of life and for sixty years meet the attacks of the colorists, who disdained anatomical truth and drawing. No man had more enemies, but he survived them all and left a work that will never perish.

Cabanel was born in 1823, and received the Grand Prize of Rome at the age of twenty-two. He had already obtained, two years before, a gold medal, which was but the forerunner of a long series of successes and honors, that terminated in his election to the Institute of France, the highest gift of his country. Like many other famous men, he was a pupil of Picot, who infused in all his pupils such sound and profound qualities. Not satisfied with his five years of study of the old masters at Rome, he afterwards went to Florence to study Ghirlandajo, and there absorbed what was best in him, copying him servilely, attempting to discover the source and truth of his realism and the spirit of the life of his time. He worked incessantly, with the self-imposed task of assuming rank among the greatest, and he arrived there by an ardent will, seconded by eminent dispositions. He is an artist of very rare talent, while personally he is elegant, handsome and distinguished, which accounts for the title of "aristocratic brush," which was given him by the critics. He became a professor, with the new organization of the school, it being the year he succeeded Horace Vernet in the French Academy. His many historical canvases will remain the finest pages in the book of modern art.

Gérôme was born the year after Cabanel, but, unlike him, he never had the Grand Prize in Rome, though he followed him to Italy, where he continued his studies under Paul Delaroche. He had as many other distinctions in life conferred on him as his colleague, and was also made a member of the Institute, and Commander of the Legion of Honor, a grade of that decoration that but six painters have ever had. He had a great success with his first picture, when only twenty-three. It is owned by the Government, who placed it in the Museum of the Luxembourg. He is a man of great talent and resources, well read, and a learned archæologist, and as such always selects subjects that require research and great qualities of study and observation. He has travelled across southern Europe, and into lower and upper Egypt; his reputation is universal, and no collection of renown is without his work; he shows the fidelity of a *savant*, with the intuitions of a poet; his classical pictures, though somewhat labored, evoke the souvenir of ancient Greece and Rome, and if his pictures are always well ordinated and clean, yet he is fine and distinguished, pure and good, laborious but exquisite, and never in sympathy with those of his countrymen who have given in to the caprices of the time to paint from imagination. In person Gérôme has a bony face, dead eyes, large forehead, once black but now grizzly hair, yellow complexion. He walks erect and stiff, is irreproachable in his dress, with his coat tightly buttoned, his cravat geometrically tied, his moustache trimmed and straight, all of which helps to explain the man's temperament as revealed in his work.

Pils was born in 1815, and took the Grand Prize of Rome at the same age as did Cabanel, and immediately after his return to France he made a brilliant début at the Salon. His medals were numerous, and other successes continued, until, in 1868, when he succeeded his own master, Picot, at the Institute. His first really great picture was "Rouget de l'Isle singing the Marseillaise," and popularized by the well-known engraving. This was a patriotic inspiration, painted during the Revolution of 1848, and led to the military subjects that made his reputation and to which he owes the celebrity of his name. His artistic career culminated in the "Battle of Alma," which will always keep his name illustrious. Pils in later life was weak and sickly, which obliged him to abandon all outside work while he was doing the four enormous panels for the Opéra of Paris. He worked on them with his habitual energy, against the protests of his friends, but succumbed just as he signed them. He virtually gave his soul, with his ebbing life, to this last great artistic effort. As a military painter, though, he will figure in history. He excelled in painting the dead and dying, the wounded and convalescent, while a sincere pity and profound emotion animated his canvases and gave them the sentiment and poetry of military life; he made you hate war but love the soldiers, through their sufferings and deprivations.

And last, though not by any means the least, I may be pardoned if I speak of my own master, Jules André, who has figured prominently in the architectural department for one quarter of a century, which began with the new organization of the third Napoleon; his studio has always been the most popular, and it obtains regularly two-thirds of the medals and other prizes, and sends more men to Rome than any other; he is a man with the purest taste and the sentiment of classic art, and has contributed to maintain this art in the route it has followed for more than a century. Though a thoughtful and learned archæologist, his knowledge does not stifle his inspirations, for he always brings out the grandeur of the style and its monumental character, while he has communicated his enthusiasm to an entire generation; he received the Grand Prize of Rome in 1848, the year of the Revolution, and at once undertook to bring out the physiognomy of the Roman monuments and the æsthetic character that belongs to each; while also studying the moulded marbles, gilded by the sun, the picturesque effects, the sombre richness of the Etruscan tombs, the lovely coloring of Pompeii, the dignity of Pæstum and the beauty of the Sicilian temples. This group of restaurations was exhibited at the Universal Exhibition of 1885, and delighted architects, artists and connoisseurs so much the government was asked to publish them, which resulted in a publication that represents heroic efforts, fatiguing journeys for distant researches in Greece, of discoveries impregnated with talent and intelligent discipline in the investigations of the principles and traditions of antiquity. His latest and greatest work, the Museum of Natural History in Paris, carried him to a seat among the forty "immortals," and gave him the grade of Officer of the Legion of Honor.

THE BUILDINGS.

By a decree of the Convention, the convent of the Little Augustins, which was founded by Margaret of Valois, first wife of Henry IV, was converted into a museum of French monuments. The archæologist Alexander Lenoir, who had made the suggestion first, was made director, and opened it September 1, 1795, with a zeal and perseverance beyond all praise. He succeeded in uniting more than five hundred monuments of ancient France, including architectural fragments, statues, bas-reliefs, tombs, divers tablets, etc., that were chronologically arranged in ten halls, built themselves with the débris of other and similar monuments; he did even more, for he compiled with a sagacity that is rare, the descriptive catalogue of this precious collection, a book so valuable to consult on any subject that relates to the ancient history of France, that it is considered an authority with archæologists. The government of the Restoration destroyed the Museum of French Monuments, and returned to the churches and convents the majority of the objects which had been taken from them during the turmoils of the Revolution. To utilize this vast site thus made vacant, it was decided to instal there the school of Fine Arts, and a well-known architect of his time was selected to adapt the locality to its new destination, but he thought of nothing better than to demolish all the buildings of the old convent, except the chapel, and erect in their place and gardens the edifices that to-day are called by the somewhat ambitious name of Palace of the Fine Arts. The plan is very irregular, and consists of a series of buildings and courts, the principal one of which is separated from the street by a handsome railing, with stone posts, holding the busts of Poussin, the painter, and Puget, the sculptor, whom the French consider the greatest masters of their respective art. The sides of the court are covered with blind arches filled in with paintings or enamelled lava, after Raphael, while at the end is the principal front of the Château d' Anet, which serves now as an entrance to the old chapel, out of which proceeds a long corridor that leads to the several amphitheatres, where lectures are given. On the fourth side of the principal court is the gateway of the Château of Cardinal of Amboise, and through it can be seen the principal front of the school, two hundred and fifty feet long; this is in the correct and elegant style that prevailed in the sixteenth century; it contains an enormous covered court in the centre, with rooms around and depending on it, for a collection of casts, the largest and finest in the world, representing the Greek, Roman and Mediæval ages, and called collectively the Gallery of Casts; on the second floor are the library, with several thousand volumes, the

Louis XIV room, with portraits of all the Academicians of his century, the Council-room, with portraits of the directors, the Model Hall, where is a remarkable collection of models of Egyptian, Greek and Roman art in cork, mostly entire buildings, the Gallery of Prizes, where can be seen all the grand prizes of Rome since 1721. On the side of the river, and facing the Louvre, are the vast Exhibition Rooms, used for the competitions of the school, the largest room of which, the Hall of Melpomene, is a splendid room rising to the roof, from which it is spaciously lighted. Here are the famous copies from the Vatican, and the penetration of the ceilings give the celebrated sibyls and prophets of Michael Angelo; the Sixtine Chapel is next to thi , and is so called because of the splendid copy of the Last Judgment, on canvas, the size of the original. The chapel contains casts of the Renaissance, among which are the tombs of the Medici, the Ghiberti Gates, and other famous pieces. The hall and chapel are poetically joined by the Pompeian Court of the Mulberry Tree, under the arches of which are fine old copies, from the antique, some having been made under Louis XIV, by his pensioners at Rome. The freize of the Parthenon is here very finely introduced in the walls on a background of dark reds; here, also, was placed the monument of Henri Regnault, who was killed during the war of 1870, and last, but not least, is the famous semi-circular room known as the Hémicycle.

THE HÉMICYCLE.

The Hémicycle is the title given to the composition which decorates the *semi-circular* wall of the amphitheatre of the school, which is set apart for the delivery of inaugural discourses and the distribution of the prizes awarded to the students.

The chairs of the professors occupy a semi-circular niche, which takes almost the diameter of the large hall, while the semi-circular benches for the students are in front; around and above them extends the wall already mentioned, which is well lighted from above.

In the year 1837 it was suggested to the government of Louis Philippe that this wall should be decorated with some appropriate subject, instead of being left bare. The idea was followed out by the Minister of the Interior, and the commission was given to Paul Delaroche. His first sketch which comprised only twenty-four figures was approved, and the contract signed for $15,000, the picture to be finished in one year. Inspired by a noble ambition to leave behind him a work that should connect his name honorably with those of the great men who had gone before him, and justify the choice of his country and the applause of Europe — as his was already a European fame — Delaroche, while adhering to his first conception, gradually enlarged it, till the twenty-four figures had extended to seventy-five, and, after nearly four years of incessant study, the magnificent composition was unveiled to the public. It received a large amount of admiration and applause, and was considered one of the greatest, if not the greatest, production of modern times; and it is proper to state that on its completion the artist absolutely refused any further remuneration than that which he at first stipulated for, a sum which scarcely repaid the cost of labor and material, while the thought and time were virtually munificently consecrated to art and to his country.

The space covered by the painting measures not less than fifty feet in length by fifteen in height. The figures in front are colossal; those further removed are life-size; the painting is in oil. All the personages are still; the animation is in the expression and attitude, without movement; the subject, as conceived by the painter, is the distribution of the prizes awarded to successful talent in the presence of an assemblage of the greatest artists of every age and country, from the era of Pericles down to that of Louis XIV. They are placed in a Temple of Fame, on the throne of which are seated Apelles, the painter, Ictinus, the architect of the Parthenon, and Phidias, the sculptor, who preside by right of their antique fame, below them four female figures that represent collectively the theory of art, and separately personify the four great influences which have developed into form in the fine arts, that is, Greek art, Roman art, Gothic or Mediæval art, and the Renaissance; while in the centre, beautiful and bold, is a half-kneeling female figure, representing the Genius of Fame distributing laurels.

This central feature of eight figures as compared to the rest of the composition is a sort of vision, combining the real and the ideal.

The architects are grouped together, as well as the sculptors and painters, these last being divided into draughtsmen, designers and colorists without any attempt at chronological order, as Delaroche considered that these men, assembled in friendly convocation, have already taken their place in the Temple of Immortality, where earthly distinctions of time and place are at an end.

THEORY OF INSTRUCTION.

In the departments of painting, sculpture, and engraving, no attempt was ever made to reduce the instruction to formula, the leaders of each generation knew that art eludes any attempt to analyze it, or fix its principles by logical deductions, and that the standard of truth should be fixed by the consent of persons of correct judgment and refined tastes, though the present training of the school can be said to be expressed in the art that culminated in the leadership of Ingres. In the architectural department until recent years the training was purely classic, though the Renaissance has now stamped its own peculiar forms upon all the work of the school, the classical traditions of the early teachers were adhered to, until the Second Empire allowed the men to give full scope to all the ability and originality they possessed. In this rapid progress towards truth and unity, were seen the advantages of the national school, as the men were equally well educated, and worked together in their professional life, while rapidly perfecting a new style of architecture of which the New Opera-House and the Trinity are the latest, and perhaps the most complete types; if there is to be a new style of architecture this school will produce it; the conditions that created the old styles are realized and appreciated, while being adapted to the requirements of our modern and advanced civilization.

Under the Second Empire enormous sums of money were spent in beautifying the capital and provincial cities; entire quarters were demolished, new boulevards cut through, streets widened and extended, elegant and costly residences replaced old ones torn down, hotels, houses, churches and public edifices were erected, all on a scale of magnificence hitherto unknown in the history of the world.

THE RESULTS OF THE WORLD'S CREATION.

Before the forming of the school the painters only walked in the paths opened for them by the Florentine and Roman masters. The Dutch and Flemish schools were enjoying great prestige, and though it had produced some great men, yet it taught art without thought, imitation without ideality or poetry, while encouraging a servile copying of nature with extraordinary minuteness of workmanship that lessened the artistic faculty, while the French at once saw and felt that art should be elevated by thought, poetry, philosophy and Christian sentiment, and the school created a species of art which was truly and conspicuously original.

As the three Louis were great patrons of ecclesiastical art, their dynasties developed the religious ideal, the Revolution created the philosophical ideal, which was followed under Louis Philippe by the Romanticists who fought against the large canvases of the First Empire and produced the Orientalists, from whom outgrew the Realists of our day. With all these struggles France has always possessed a true school, which produced a succession of great men, who have ever upheld its traditions, men who united nobleness and dignity of form to the most conscientious adherence to nature, who brought to the service of their realism a profound knowledge of coloring, a correctness of design and truth of expression, which won for them the highest positions in the hierarchy of art; they have created a school which is poetical in the lyric sense of the word, possessed with great religious feeling, a high appreciation of nature, and, above all, historical in the highest degree, endeavoring to record with pencil and brush, the ideas, manners, and events of the times in which it existed, and have, since its existence, created the most original, the most varied, and the most national school in the whole history of art.

THE ILLUSTRATIONS

Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

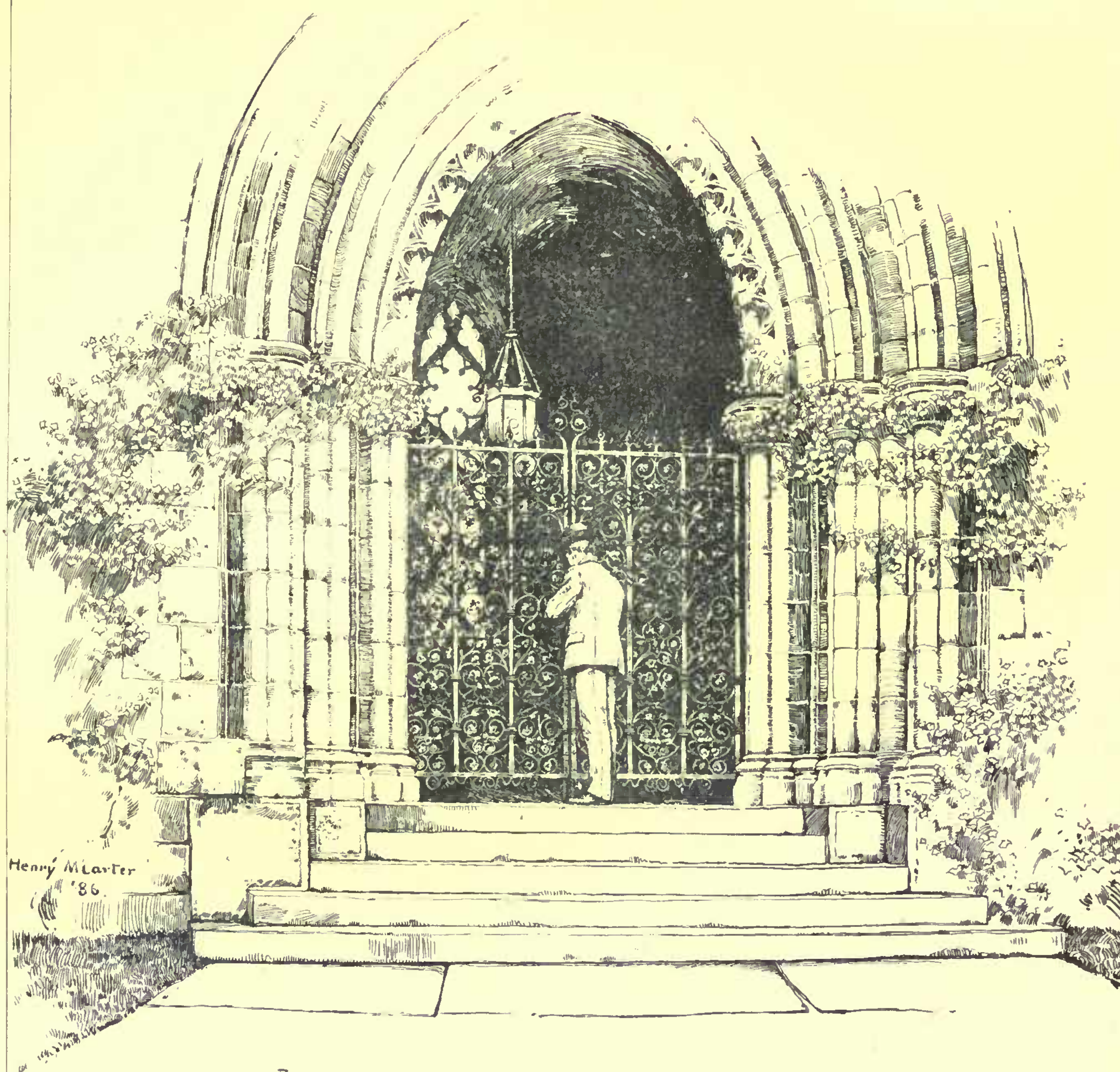
STAIRCASE IN THE HOUSE OF THE LATE HENRY W. LONGFELLOW, ESQ., CAMBRIDGE, MASS.

[Gelatine print issued only with the Imperial and Gelatine editions.]

THE ASTRAL APARTMENTS, GREENPOINT, N. Y. MESSRS. LAMB & RICH, ARCHITECTS, AND MR. E. L. ROBERTS, CONSULTING ARCHITECT, NEW YORK, N. Y.

SINCE the "Stewart Home for Working Women" was started in New York many years ago, attention has been repeatedly called to the great need of a good, comfortable home, not only for working women, but for a large class of people who want a home near their work, or business, in which they can live with comfort at a small cost. It has not been difficult to find such a place for those who could pay from $75 to $150 per month rent, but the difficulty has been to find a good home with plenty of light, pure air and pleasant surroundings at a rent of from $12 to $30 per month. The classes which it is desired to accommodate are: The widow who has lived in affluence but has been reduced in circumstances and feels that she must make a home for her children; for the shop-girl, who has to go early and stay late at her work, and for the clerk, or tradesman, who needs to save from his salary or small capital. There is also a large class whose circumstances, from one cause or another, require a comfortable home at a moderate rent. The number embraced in this class is much larger than would appear, perhaps, on first thought. Added to the above is the great body of first-class mechanics who have families, often cultured to a high degree and who can appreciate a home with cheerful surroundings. But how can it be had within easy reach of their business, where, within an hour's nooning, they can take their mid-day meal at home?

Mr. Charles Pratt, of Brooklyn, has, for a number of years, been endeavoring to practically supply this great want by the erection of a building or buildings which would be the best and most perfect possible solution of the working-man's home problem and to alleviate in some measure the suffering caused by a lack of proper home conveniences. In the solution of this problem, with all its difficulties, his

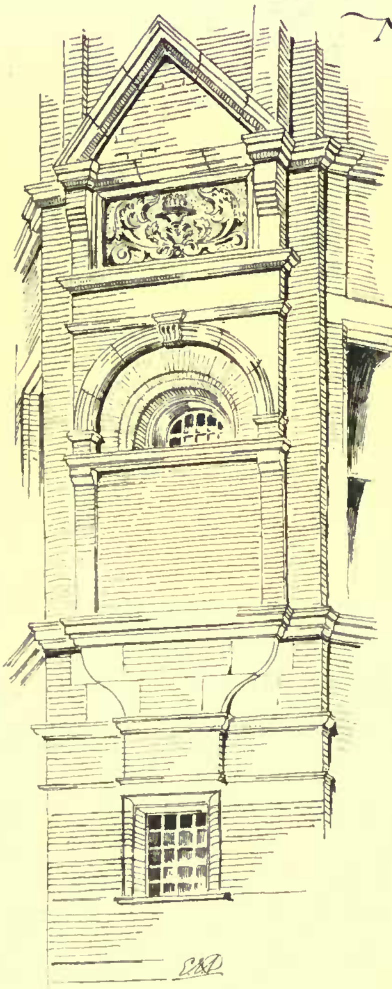


Doorway in Tower of Church at Thirty-seventh and Chestnut St. Philadelphia, Pa.
Theophilus P. Chandler, Jr. Architect

Heliotype Printing Co Boston

THE WARREN Suburban

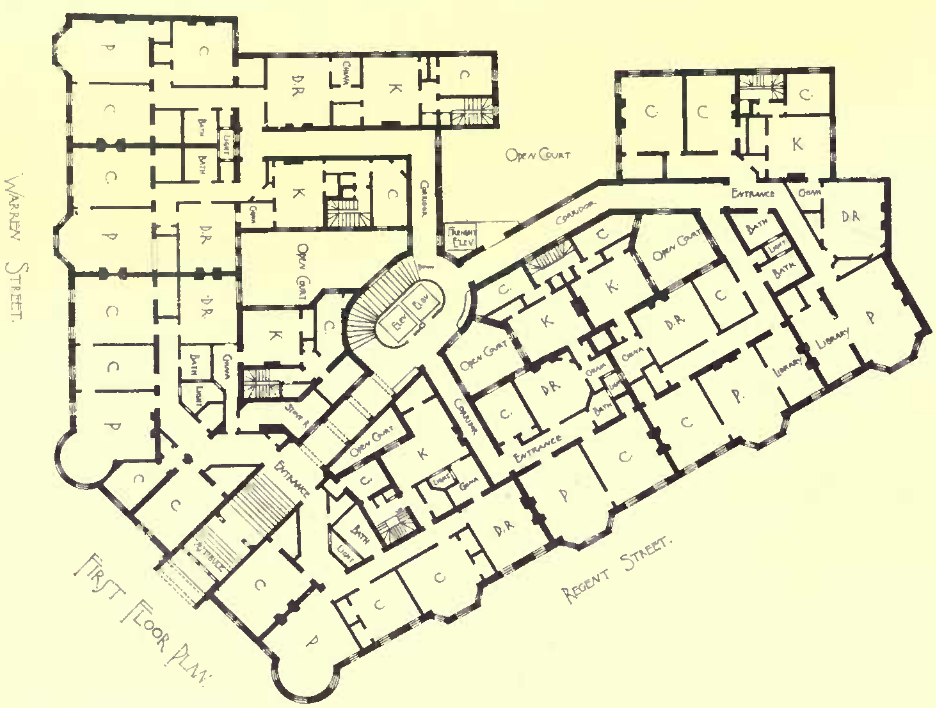
Mr. Carl Fehmer, Archt.



Detail of Bay on West Side.



General View



First Floor Plan.



Entrance

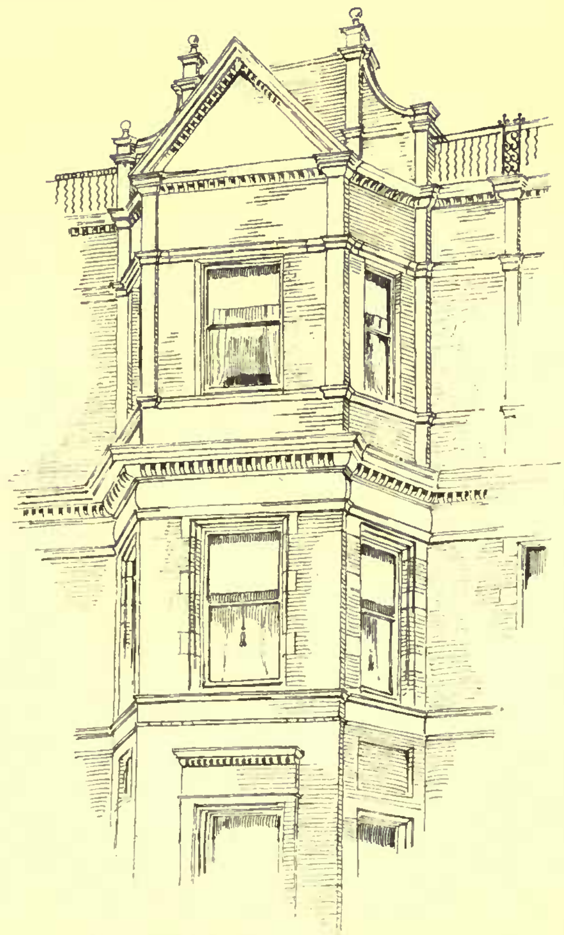
Sketches by E. Eldon Deane

KNOR & Co.

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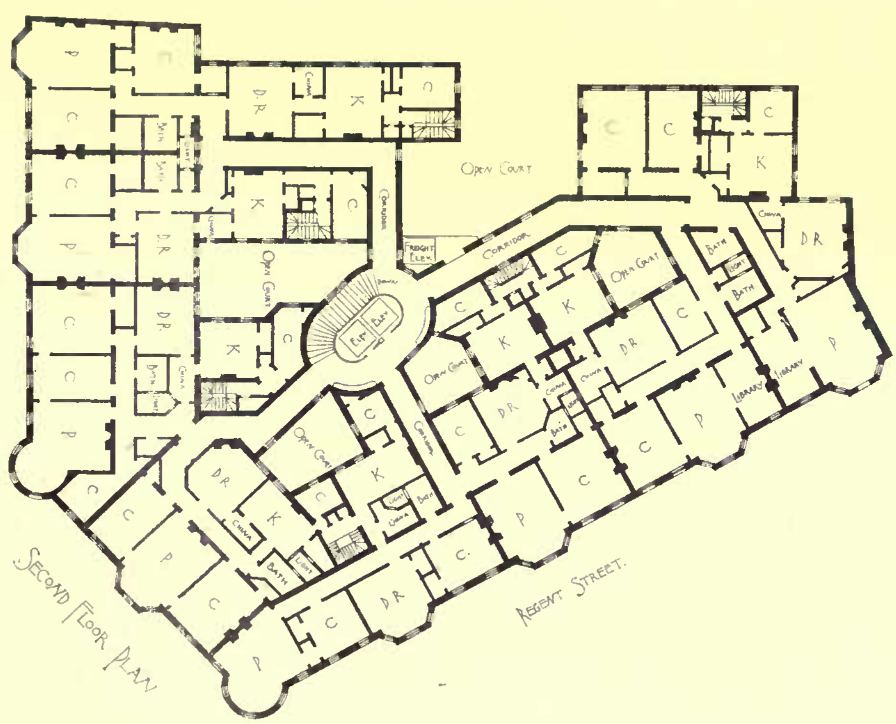


ng up Warren St.



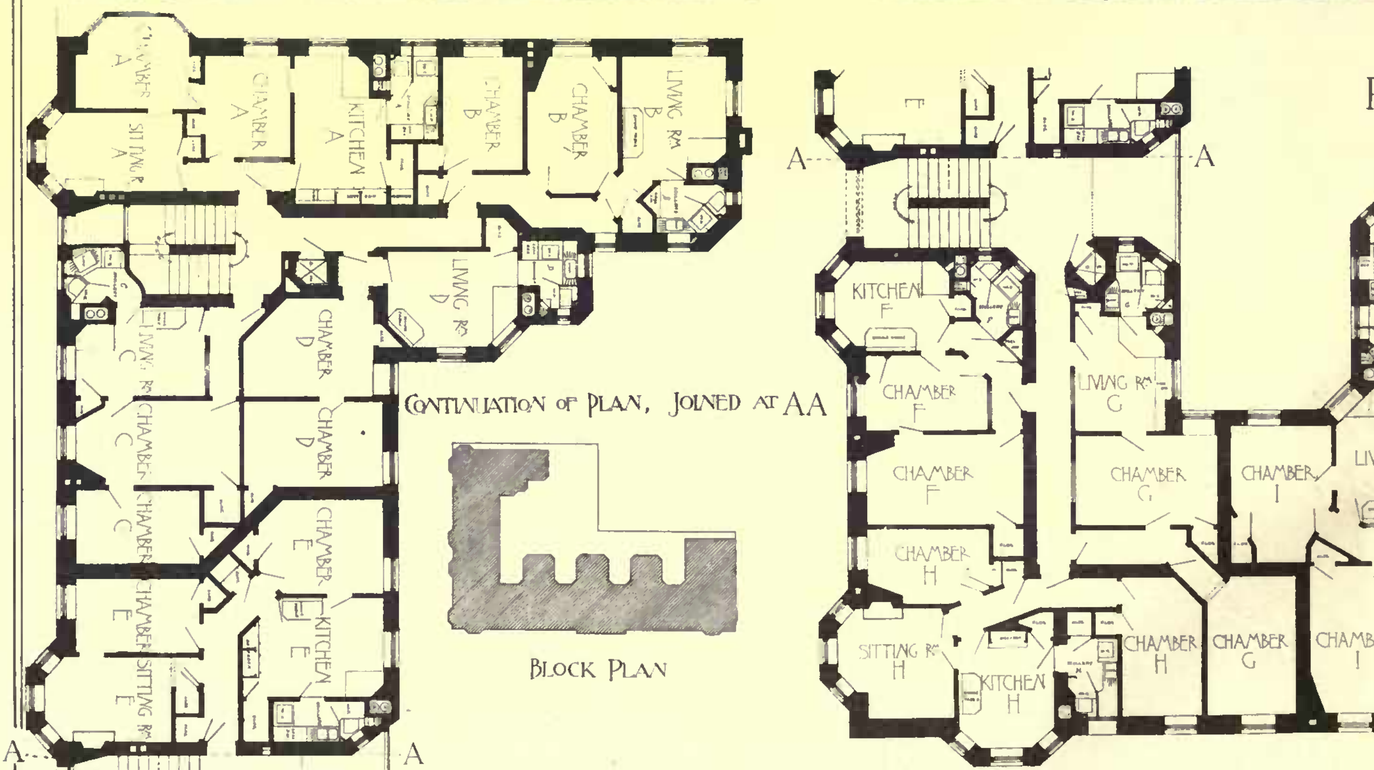
One of the Bays.





THE · ASTRAL · Franklin · Java and · India · Streets · Greenpoint · New York

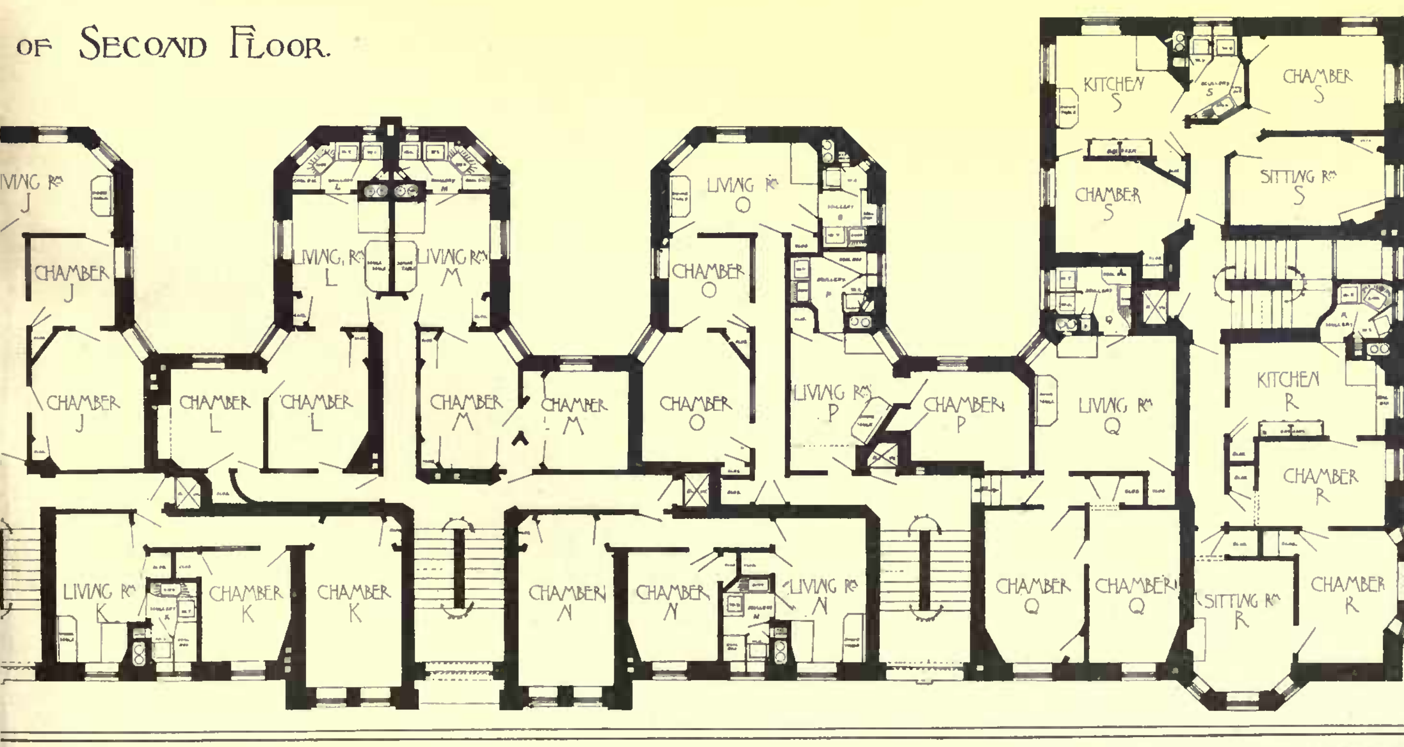




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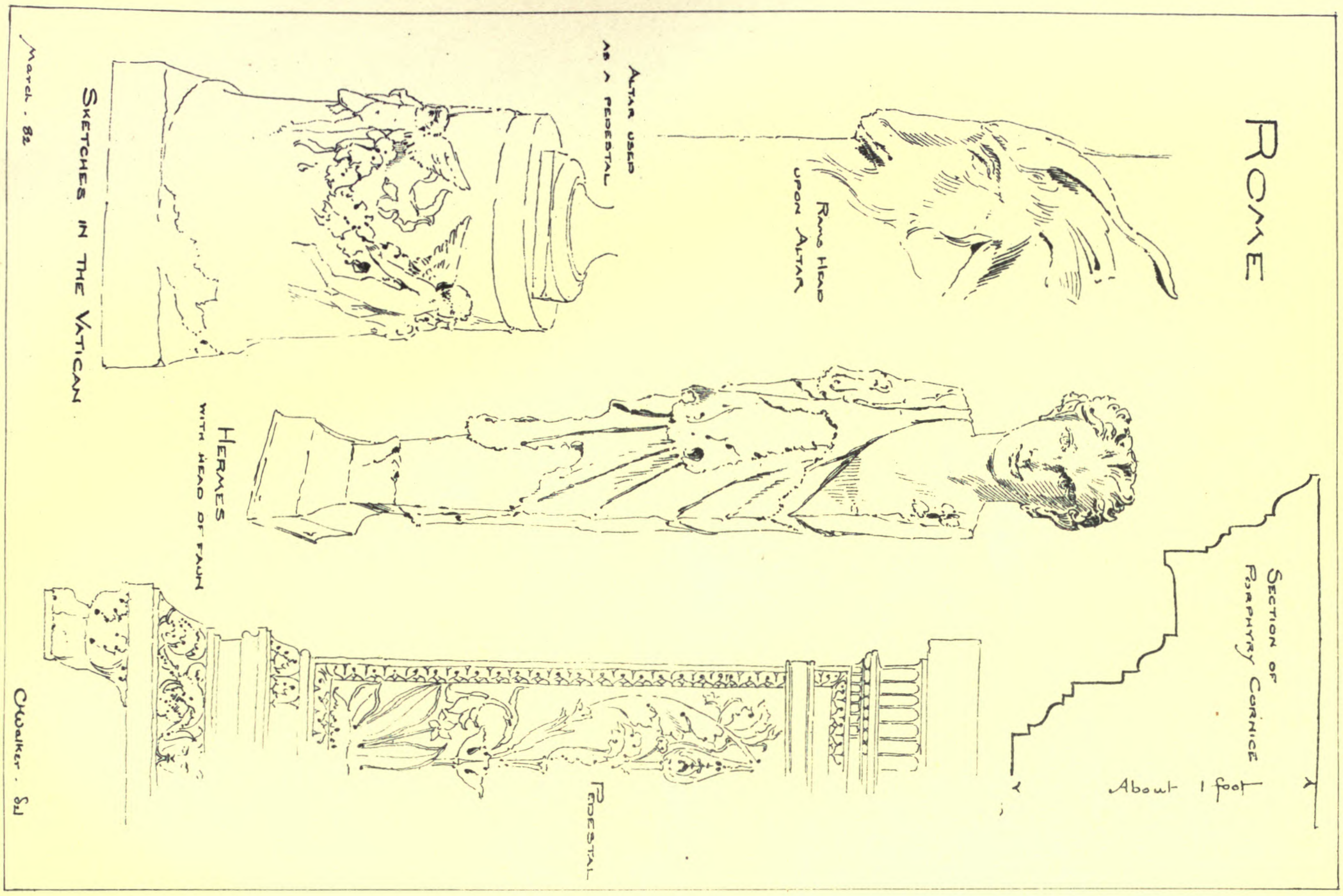


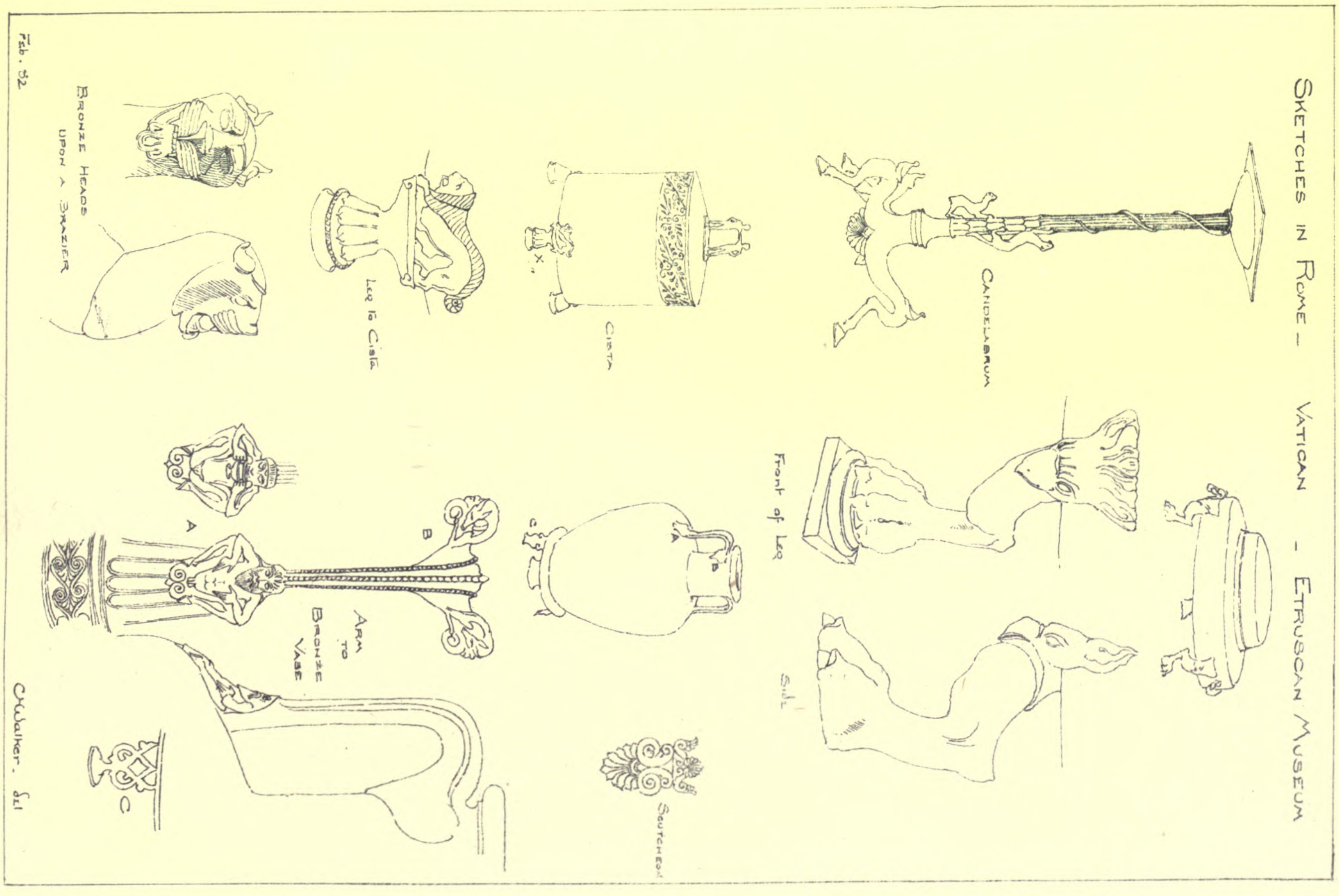
OF SECOND FLOOR.



Heliotype Printing Co Boston.

AMERICAN ARCHITECT AND BUILDING NEWS, NOV. 13, 1886. No. 568





Heliotype Printing Co Boston.

architects, and others employed expressly for this purpose, have visited the different cities of our country, and made careful study of what has been done in London by Hon. George Peabody and others, as well as the many excellent homes, either detached or in compartment form, in other parts of Europe. Thus, from the best experience of the past the aim has been to see how the greatest home comfort could be had for the smallest rent, and the conclusion arrived at has been, all things considered, that an apartment-home, properly constructed, would best attain this result. Having fixed upon the style of building, the next object was to secure a location which would be the nearest approach possible to the largest number to be benefited. It must be in a healthy and unexceptionable neighborhood, and to this end, as a result of much careful thought and investigation, a plot of land was secured on Franklin Street, on the highest ground in Greenpoint, with excellent drainage and on good, natural, gravel-soil bottom, within five minutes' walk from the Tenth and Twenty-third Street ferries from New York, and situated in the centre of a large population, convenient to schools, churches and every means of refinement.

The building is to be known as "The Astral Apartments," and it may seem needless to say that every detail has had thoughtful consideration. The construction of the building was put in the hands of the Morris Building Company, who have been constantly at work for more than two years in the preparation of plans, etc. The edifice is rapidly nearing completion and may be described, briefly, as follows:

The principal features of the construction are perfect light, ventilation and sanitary arrangements. Buildings of a like nature, although on a smaller scale, have been examined with a view to remedy the defects which experience has brought to light, and it is believed that the present building will be the most perfect example of an apartment-house in the country. The apartments are totally isolated from one another by fire-walls; they have outside light and ventilation to every room, the means of escape in case of fire are ample, and, above all, the sanitary arrangements are absolutely perfect, and of sufficient extent to give every occupant the proper conveniences of living. A study of the plan will serve to show how perfectly these requisites have been carried out.

The building fronts on Franklin Street 200 feet, on Java Street 135 feet, and on India Street 75 feet, and it will be noticed that at intervals in each façade are openings extending from basement to attic, which, while enclosing the staircases, leave them open for perfect ventilation and light. They will be seen to divide the building into different sections with six distinct sets of staircases, which are built of stone between massive fire-walls. Added to this, to make assurance doubly sure, regular fire-escapes have been placed in the rear of the whole system, connecting each story from roof to basement. From the landings of main staircases the different apartments are entered through separate hallways, and each set of rooms is connected with a large lift built in a brick shaft and supplied with metal doors at each story.

An examination of the apartments themselves will show that they consist of from three to five rooms each, thus giving accommodations for large or small families. The English system has been adopted in the culinary departments, giving a good-sized "living-room," off from which is the "scullery," containing the sink, a set of wash-trays and a large fuel-box, besides access to the water-closet, every one of which has direct outside light and air. By an ingenious location of the chimneys, they are also made to serve as direct ventilating-flues from each closet. All the plumbing is thus brought into direct lines through the stories, and the pipes are laid so as to be exposed for cleanliness and inspection.

In the basement, on India Street, is a large reading-room and library, open from side to side for light and ventilation, containing an immense terra-cotta chimney-piece, to give it a home-like appearance. On the corners of the first story are stores, designed to be conducted upon some coöperative plan as a source of revenue to reduce the rent.

From a view of the exterior it will be seen that the tremendous size of the building has led the architects to the massive round-arch style of architecture, and the doorways are thus formed by the noble Norman archways, the central façade on Franklin Street being rock-face stonework through the first and second stories, and running up in a double bay, projecting four feet, are united again at the top by an arch and covered cornice of terra-cotta. Each corner, also, of each façade is flanked by projecting bays of brick, and the whole building is capped by an arcaded cornice of brick and terra-cotta, the gables having massive flanking chimneys. Brown-stone is used as the foundation of the first story up to the window-sills, with the central façades of the same material; otherwise, the whole structure is of brick, the ornamentation being quiet and refined in stone and terra-cotta.

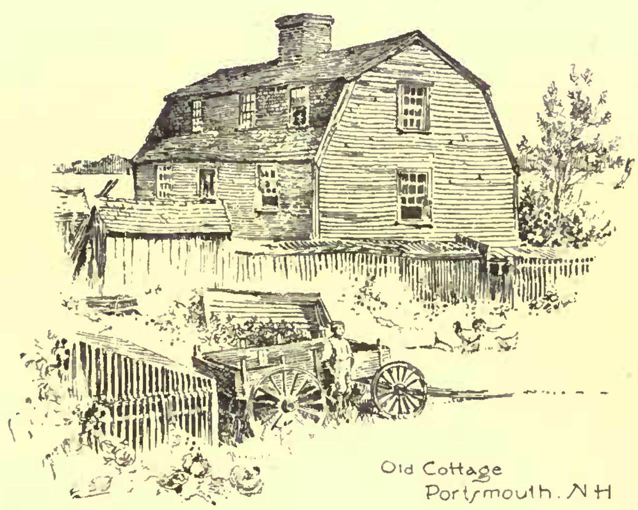
The cost of the entire property will be from $250,000 to $275,000. The building is being erected by Van Dolsen & Arnott, builders.

"THE WARREN," ROXBURY, MASS. MR. CARL FEHMER, ARCHITECT, BOSTON, MASS.

SKETCHES MADE IN THE VATICAN MUSEUM, ROME, BY MR. C. H. WALKER, ARCHITECT, BOSTON, MASS.

DOORWAY OF CHURCH, CORNER OF THIRTY-SEVENTH AND CHESTNUT STREETS, PHILADELPHIA, PA. MR. T. P. CHANDLER, JR., ARCHITECT, PHILADELPHIA, PA.

THE TREATMENT OF SEWAGE.[1] — II.



SEWAGE.

WE now turn to water-carried sewage — its composition, value and treatment.

By the phrase "the sewage of a town" is implied: —

(1) The excreta (solid and liquid) of the population.

(2) The refuse from kitchens, laundries, etc.

(3) The drainings from stables, slaughter-houses, etc.

(4) The liquid impurities resulting from various trade operations (breweries, dye-houses, fellmongeries, etc.)

(5) The washings of public thoroughfares, etc.

(6) Domestic and subsoil water.

To speak broadly, we may define sewage as "the refuse of communities — their habitations, streets and factories."

It is manifest, therefore, that it is not possible to define broadly what constitutes "average sewage." The quantity and quality of the sewage of a town will be influenced by the following, amongst other conditions: —

(1) The number and nature of the manufactures and trade operations peculiar to the place, and which are drained into the sewers.

(2) The existence of an excessive number of stables (such as result from the presence of barracks).

(3) The volume of water supplied to the inhabitants.

(4) The proportion of rain or surface water admitted into the sewers.

(5) The quantity of subsoil-water that leaks into the sewers.

(6) The density and general habits of the people.

(7) The season of the year.

(8) The time of day.

Sewage may be subdivided into —

1. Domestic sewage.
2. Manufacturing refuse.
3. Rain and storm water.

We shall find, when we come to discuss the treatment of sewage, the first great difficulty is the large quantity to be dealt with. It has been suggested to meet this difficulty of quantity by adopting a duplicate set of sewers, the one for sewage proper (domestic and manufacturing) and the other for storm and rain water, or at any rate for the larger part of the rain-water. For irrigation purposes, no doubt, it is desirable to have the domestic sewage as little diluted as possible, but for chemical treatment dilution within certain limits is not an evil. A separate system must be more expensive, besides which it robs the sewers of one means of natural and effective flushing, such as occurs after heavy rains. It also excludes from the sewage to be treated many materials (*e. g.* road-washings) that certainly need treatment as much as, if not more than, any sewage proper. To limit the water for removal of filth to its smallest quantity is a sound principle, but there is a danger in over-reduction. The most earnest advocates of the separate system scarcely see their way to exclude from the public sewers the rain falling on private property, as this would for the most part necessitate two sets of house drains. It may be admitted that both the separate and combined systems have their merits and defects, and that certain local conditions may determine the choice of the system.

The arguments used in favor of a separate system are: —

(1) Greater uniformity in the quantity of sewage conveyed.

(2) The prevention of deposits, the dimensions of the pipes being capable of more accurate adjustment, permitting them to be daily filled to their maximum at the hour of maximum flow.

(3) If the sewage has to be pumped, expense will be saved by the limitation of quantity.

[1] A paper by Dr. C. Meymott Tidy, read before the Society of Arts, April 14, 1886, and published in the *Journal* of the Society. Continued from No. 566 page 208.

(4) Prevention of floodings from the capacity of the sewers being overtaxed, or from obstruction taking place in the surface channels during times of heavy rain, or on the occurrence of a rapid thaw after a long period of snow. Danger arising from the gases in the sewers being forced by the rush of water thus filling the sewer, being driven through the nearest outlet, and possibly through house connections, will be avoided.

(5) Prevention of precipitation, and so of deposit in the sewers, from earthy matters (such as building lime) being carried in at storm time, together with road detritus, leaves, etc., and which, under ordinary conditions, might not be removed until the next heavy rain.

(6) If obstruction occurs, a comparatively small volume of water will be sufficient to flush the sewers effectively on account of the relative smallness of pipes.

(7) That with small pipes, good ventilation of the sewers may be more easily effected.

(8) That the nuisance arising from organic matters being carried into the pipes at the time of storm, and putrefying on the upper portions of the sewer-pipe, where, under normal conditions of flow, it forms a slimy coating and develops swarms of organisms, will be prevented, the sewers being filled daily to their maximum working capacity.

(9) That the quantity of sewage to be dealt with would be greatly decreased.

On the other side it is urged that, however sound it may appear in theory, to urge "the rainfall to the river, the sewage to the soil," there are manifest objections to the separate system: —

1. That it is practically impossible thus to separate rain-water and sewage, things that ought not to be in the rain-water pipes being certain to get there.

2. That the road-washings and filth making the first wash of a heavy storm is most often far more filthy than the very worst sewage, and, therefore, specially requires treatment.

3. That storm-water is the natural flush-water for the sewers.

It may be said that the third objection may be met by automatic flush-tanks; the second by effective scavenging; the first by educating the people. We have not yet attained the ideal of sanitary work. A separate system would, I fear, mean the intermittent pollution of our water-courses. There are legal difficulties, too, in carrying it out, which I will not discuss.

I do not deal with the question of cost, except to say that the mere size of pipe is not the only, nor is it the main question to be considered in laying pipes, the excavation, paving, etc., being practically the same, whether pipes be large or small.

COMPOSITION OF SEWAGE.

Sewage, we have said, is a complex fluid: — no absolute average analysis can therefore be stated. It will, however, be a good starting point to regard the average sewage of London as a standard, and to speak of sewage of greater polluting power as a strong sewage, and of less polluting power as a weak sewage.

A large number of samples of London sewage were examined by Dr. Frankland and myself between 1883 and 1884. The following are certain average details worthy of record. The results are stated in grains per gallon of 70,000 grains : —

	Maximum.	Minimum.	Average.
Matters in solution	49.77	28.42	45.213
Matters in suspension	163.9	21.4	48.65
Ammonia	6.527	2.515	3.012
Chlorine	8.33	5.67	7.21
Organic carbon	2.847	2.118	3.069
Organic nitrogen	2.676	0.964	1.738

Average ratio of N to C — 1 : 1·77.

These results, however, take no note of true storm sewage.

Whilst an assistant of Dr. Letheby, I made, jointly with him, a very large series of analyses of sewage from ten of the large city sewers, the rate of flow being, on an average, 3,500 gallons per minute. The following are average details: —

	Day sewage.	Night sewage.	Storm sewage.
Soluble Matters	55.74	65.09	70.26
(*a.*) *Organic*	15.08	7.42	14.75
Containing nitrogen	5.44	5.19	7.26
(*b.*) *Mineral*	40.66	57.67	55.71
Containing phosphoric acid..	0.85	0.69	1.03
" potash	1.21	1.15	1.61
Suspended Matters	38.15	13.99	31.88
(*a.*) *Organic*	16.11	7.48	17.55
Containing nitrogen	0.78	0.29	0.67
(*b.*) *Mineral*	22.04	6.51	14.33
Containing phosphoric acid.	0.89	0.64	0.98
" potash	0.08	0.04	0.16

It may be of importance to record that at the time the samples were collected for analysis, 37.5 gallons (6 cubic feet) were contributed per head of the population. Of this, 80 per cent was represented by the water-supply. The following Table exhibits, therefore, the weight in pounds of the chief constituents of 375,000 gallons of sewage (mid-day sewage being taken for comparison) furnished daily by 10,000 people, and its subdivison into excretal and non-excretal refuse: —

Constituents of 375,000 gallons.	From excreta.	From refuse other than excreta.	Total.
	lbs.	lbs.	lbs.
Soluble Matters	957	2029	2986
(*a.*) *Organic*	733	75	808
Containing nitrogen	200	91 (?)	291
(*b.*) *Mineral*	224	1954	2178
Containing phosphoric acid.	30	16	46
" potash	34	31	65
Suspended Matters	316	1628	2044
(*a.*) *Organic*	356	507	865
Containing nitrogen	23	19	42
(*b.*) *Mineral*	60	1121	1181
Containing phosphoric acid.	21	27	48
" potash	8	—	8

Putting those results in a few words, we may say every 10,000 persons in London contribute, on an average, 375,000 gallons of sewage daily, and that this includes about 1,671 lbs. of organic matter, containing 333 lbs. of nitrogen, and 335 lbs. of mineral matter, containing 94 lbs. of phosphoric acid and 69 lbs. of potash.

Of course, the total quantity in any given town will depend on a variety of causes. It is certain to be as much as the water-supply, but it may be a great deal more. In London, as we have said, it may be taken that 80 per cent of the sewage is represented by the water-supply.

Hofman and Witt (1857) examined the sewage from the Savoy Street sewer, an average sample being obtained by the admixture of samples taken hourly during the twenty-four hours. The results were as follows, stated in grains per gallon: —

(*a.*) *Organic*	30.70
Containing nitrogen	6.76
(*b.*) *Mineral* —	(?)
Containing phosphoric acid	1.85
" potash	1.03

A large number of sludge deposits (to which no precipitant was added) have been examined for the purpose of determining the ratio of organic nitrogen to organic carbon. The results are marked by a great want of uniformity, ranging from a ratio of 1 to 3.4, to a ratio of 1 to 9.1.

Major Scott, after a review of a large number of analyses, says, "we may assume that with each [one] part of the three fertilizers, nitrogen, phosphoric acid and potash, there will be associated in the sewage sludge of London 20 parts, 25 parts and 56 parts respectively of organic matter."

Nitrogen or organic matter	1 : 20
Phosphoric acid to organic matter	1 : 25
Potash to organic matter	1 : 56

It will be impossible for us to discuss the pollution from sources other than excreta which, together, make up the complex fluid we designate sewage. With respect, however, to stable drainage, I would note that an average horse excretes thirteen times as much fæcal matter by weight, and about fifteen times as much urine, as an adult man. It may be noted further, that both horses and cows produce by respiration about thirteen or fourteen times as much carbonic acid as an adult man, and as a consequence vitiate the air in the same ratio. (Taking 1,200 cubic inches as the quantity of CO_2 produced per hour, by a man, 14,750 inches is produced by a cow or horse.)

There is, however, a not unimportant consideration which occurs in considering the character of a town sewage, viz., the feeding of horses. The difficulty of dealing with the stable refuse where the horses have been fed upon maize, is far greater than where the animals have been fed on ordinary corn. In my own experience as a health officer I have had abundant evidence of the peculiarly offensive character of the manure in such cases.

In all inquiries respecting the sewage of a town, the nature and amount of the liquid refuse from manufacturing works (if admitted into the sewers) needs most careful consideration. Of these I may specially mention brewery refuse, the waste being of a singularly offensive nature. To add to the difficulty, a considerable quantity of yeast is discharged with the waste liquor, whilst the high temperature of the refuse intensifies the trouble of treatment. The refuse from certain dye-works, etc., are also difficult to deal with.

As regards street-washings, the following details may be worth noting: — Granite roads were found at the time of a heavy shower to discharge water into the gullies containing 800 grains of solid matter per gallon, of which 219 grains were in solution and 520 in suspension. The precise composition of the washings, will, however, depend on many conditions, such as extent of traffic, previous period of drought, etc. The water from wood paving, taken about the same time as the above, was found to contain 50 grains of solid matter per gallon, of which 40 was in solution and 10 in suspension. Some 20 samples of road-washings taken from all kinds of roads under circumstances as nearly as possible similar to the conditions named above, were mixed together. The water contained 280 grains of solid matter per gallon, of which 120 were in solution and 160 in suspension.

It would be outside my province to discuss the engineering details of a sewage scheme. Yet let me note that sanitary medicine must take cognizance of sewage in its progress through a town. There must be sufficient velocity, as well as an economy of scouring power,

in order to prevent the solid matters from collecting. The ventilation of the sewers is again a question of importance upon which authorities differ, and no wonder, seeing how formidable are the difficulties.

DISCHARGE OF CRUDE SEWAGE INTO RIVERS.

Nothing is more certain than that the discharge of crude sewage into a river is unadvisable. It is, in fact, a method of shifting a nuisance from the nuisance-producer to his immediate neighbor. The evils arising from such discharge depend mainly upon the suspended matter in the sewage. This, first of all, floats about near the outfall, certain portions of the organic matter combining with aluminous compounds from alluvial mud raised by tides and steamers. In time, deposition takes place. In the course of flow the various ingredients are found to deposit more or less in the order of their specific gravity. The first deposits are mainly mineral, with small quantities of organic matter carried down at the same time. The later deposits are mostly finely divided organic matter, along with a small quantity of mineral matter. Thus there occurs, as the result of flow, a natural sorting of the matters in suspension.

The organic impurities of the sewage in this manner collect in the bed of the river and ultimately putrefy. The gases developed and bottled up in time render the solids sufficiently buoyant to rise to the surface where the gases of putrefaction (sulphur and phosphorus compounds for the most part) are given off, the solid matter again sinking to undergo fresh putrefactive changes.

Thus the nuisance from the discharge of sewage into the river may be far more offensive at a short distance from the outfall, than at the outfall itself. Further, at a point of slack water, the nuisance arising from these solids in suspension may be greatly aggravated.

As regards the matters in solution, provided the sewage be sufficiently diluted and allowed a certain flow, complete purification will be effected by oxidation. This fact is nowadays admitted by nearly all chemists, and need not detain us further. The self-purification of running water is, however, not to be regarded as an argument in support of allowing crude sewage to be discharged into a river.

Before dealing in detail with the value and the treatment of sewage, a few historical details may be permitted.

A Royal Commission was appointed in 1857 (known as "The Sewage of Towns Commission") to inquire into the best mode of distributing the sewage of towns, and applying it to beneficial and profitable uses. Their deliberations lasted for eight years, a preliminary report being made in 1858, a second in 1861, and a final report in 1865. Their conclusions were in favor of irrigation, their belief being that irrigation processes might be made more or less profitable. They say: —

"1. The right way to dispose of town sewage is to apply it continuously to land, and it is only by such application that the pollution of rivers can be avoided."

"2. The financial results of a continuous application of sewage to land differ under different local circumstances; first, because in some places irrigation can be effected by gravity, while in other places more or less pumping must be employed; secondly, because heavy soils (which in given localities may alone be available for the purpose), are less fit than light soils for continuous irrigation by sewage."

"3. Where local circumstances are favorable, and undue expenditure is avoided, towns may derive profit, more or less considerable, from applying their sewage in agriculture. Under opposite circumstances, there may not be a balance of profit; but even in such cases a rate in aid, required to cover any loss, needs not be of large amount."

In 1862 (*i. e.*, during the life of the previous Commission) a select committee of the House of Commons was appointed (called Select Committee on the Sewage of Towns) to inquire into "the best means of utilizing the sewage of the cities and towns of England, with a view to the reduction of local taxation, and the benefit of agriculture." They reported in April and July of 1862.

In May, 1865, the first Rivers' Pollution Commission was appointed "to inquire into the best means of preventing the pollution of rivers." They made three reports, the first in 1866, and the second and third in 1867. In February, 1868, their commission was revoked, a second Rivers' Pollution Commission being appointed in April of that year. The subjects embraced in the reports of the two Rivers' Pollution Commissions may be best stated in the language of their commissions. They were appointed "for the purpose of inquiring how far the present use of rivers or running waters in England for the purpose of carrying off the sewage of towns and populous places, and the refuse arising from industrial processes and manufactures, can be prevented without risk to the public health, or serious injury to such processes and manufactures, and how far such sewage and refuse can be utilized and got rid of otherwise than by discharge into rivers or running waters, or rendered harmless before reaching them; and also for the purpose of inquiring into the effect on the drainage of lands and inhabited places, of obstructions to the natural flow of rivers or streams, caused by mills, weirs, locks, or other navigation works, and into the best means of remedying any evils hence arising." This Commission made six reports, the first in 1870, and the sixth in 1874.

In 1875, a committee of the Local Government Board was appointed to make special inquiry into the practical efficiency of the chief systems of sewage disposals then in operation, and for which loans had been sanctioned by the Board. It reported in 1876 (Sewage Disposal, Report of a Committee, 1876): —

"4. That most rivers and streams are polluted by a discharge into them of crude sewage, which practice is highly objectionable."

"5. That, as far as we have been able to ascertain, none of the existing modes of treating town sewage by deposition and by chemicals in tanks appear to effect much change beyond the separation of the solids and the clarification of the liquid. That the treatment of sewage in this manner, however, effects a considerable improvement, and, when carried to its greatest perfection, may in some cases be accepted."

"6. That, so far as our examinations extend, none of the manufactured manures made by manipulating town's refuse, with or without chemicals, pay the contingent costs of such modes of treatment; neither has any mode of dealing separately with excreta, so as to defray the cost of collection and preparation by a sale of the manure, been brought under our notice."

"7. That town sewage can best and most cheaply be disposed of and purified by the process of land irrigation for agricultural purposes, where local conditions are favorable to its application, but that the chemical value of sewage is greatly reduced to the farmer by the fact that it must be disposed of day by day throughout the entire year, and that its volume is generally greatest when it is of the least service to the land."

"8. That land irrigation is not practicable in all cases; and, therefore, other modes of dealing with sewage must be allowed."

This being the sewage with which we have to deal, our object is twofold: —

(1) To make use of any valuable constituents that it may contain; and

(2) To purify it.

Sanitary requirements, however, demand that no nuisance should result in the course of the operation of treatment.

THE VALUE OF SEWAGE.

The basis on which the theoretical calculation of the value of sewage may be determined is, authorities suggest, simplicity itself.

It may be conceded that the animal excreta are, practically, the only constituents of manurial value.

Having determined the value of the excreta of a mixed population, it is only necessary to know (1) the population of any given town, and (2) the quantity of sewage produced during the twenty-four hours, to estimate the manurial value of the sewage. It may appear strange, however, the question being one, we are told, of such simplicity, that authorities before the Select Committee of the House of Commons (1862) should have stated it so variously as from ½*d*. to 9*d*. per ton. Certain details upon which these money estimates were founded may be noticed.

The Rivers' Pollution Commissioners, who fix its value at about 2*d*. per ton, say, "The money value of these constituents (combined nitrogen, phosphoric acid and salts of potash), dissolved in 100 tons of average sewage, is about 15*s*., whilst that of the suspended matters is about 2*s*. That is to say, that 100 tons of average sewage are worth 17*s*., or about 2*d*. per ton."

Hofmann and Witt arrived at a similar conclusion. Six-sevenths, they say, of the valuable matters in sewage are in solution. Reckon that 700 tons of sewage contains one ton of solid matter, having a total money value of £6 0*s*. 3*d*. (£5 5*s*. for dissolved matters, and 15*s*. 3*d*. for suspended matters), it follows that the one ton of sewage is worth about 2*d*.

Lawes and Gilbert arrive at a similar conclusion. Reckoning the dry-weather sewage of London as 24 gallons daily per head (= 40 tons per head per annum), and the ammonia as 10 lbs. per head per annum, the money value would be 2*d*. per ton, whilst if the ammonia be taken at 12½ lbs. per head per annum, it would be 2¼*d*. per ton.

Take it, says another authority (Mr. Bailey Denton), that the fertilizing elements of one person (worth, let us say, 8*s*. 4*d*. per year) are diluted with 61 tons of water (an average quantity contributed by each individual to the outflow from towns), the value of sewage is 8*s*. 4*d*. divided by 61, or 1⅝*d*. per ton.

Such are some of the estimates.

But there were those who desired to be still more precise in their calculations. Authorities who desired to be cautious valued the London sewage, when the population was 3,000,000, at £1,000,000 sterling, that is at the low estimate (ridiculous to many people of 6*s*. 8*d*. as the annual value of each person's excreta). The two chairmen of Parliamentary committees (Mr. Brady and Lord Robert Montagu), after a long inquiry, came to the conclusion that London sewage is equal in manurial value to 212,842 tons of Peruvian guano, with a market price of £2,890,000. Hofmann and Frankland considered that 1,250 tons of London sewage contained the fertilizing matters of one ton of Puruvian guano, whilst a very great authority indeed, one before whom the chemical world justly bows in admiration would listen to nothing less as the annual value of the metropolitan sewage than £4,081,430.[2]

Such being the teaching of science as to the value of sewage, nothing was more natural than to urge upon authorities its application to land. And here let me say at once, that I distinguish between utilization of the sewage and its purification. I consider them together, but they are totally different questions.

Science had its story to tell. The land acts, first, as a mechanical filter, and, secondly, as a chemical laboratory. As a filter, the larger insoluble particles are arrested on its surface, whilst the smaller are

[2] See Voelcker's report on the "Commercial Value of Sewage and Soil Manures," published in the report of Messrs. Rawlinson and Read to the Local Government Board.

entrapped a few inches down. The water is absorbed, *i. e.*, each earth particle becomes covered with a liquid coating. Now follows the work of the chemical laboratory. The enormous surface of liquid thus formed is favorable to coercing the combination of oxygen with the organic impurities of this subdivided sewage-water, carbonic acid and water together with nitric acid, oxidation being assisted possibly by the presence of certain micro-organisms resulting. The organic matters on the surface soon undergo slow burning. The nitric acid is your plant feeder.

The process of slow burning is the work of oxygen, whilst that of nitrification, as the researches of Pasteur and Warrington have shown, is due to the combined work of oxygen and of certain lower forms of life. Hence, to purify, you need not only a flow of sewage but a flow of air, that is, constant movement regulated in its order. As regards the lower organisms, they may be already in the soil or be provided by the sewage. The purifying power of a soil, however, is peculiar to itself. You cannot completely control aëration, although drainage and loosening of soil will promote it, and an excess of irrigation stop it. In fact, the soil as a purifying agent, is to say the least capricious.

Purification, the action of the soil, is greatly assisted by the action of vegetation. In winter time, when there is no vegetation, the soil only must do the work.

Enthusiasts full of faith were found to embark in private sewage-farms, whilst local authorities, anxious to save the rates, offered the sewage to farmers in their neighborhood for a corresponding return.

It was not long, however, before a certain unpleasant awakening occurred, owing to the farmers declining even to accept the sewage.

Reasons for this were sought. Was it due, as was suggested, to the ignorance of farmers, and their blind attachment to old-fashioned ways? This contention was scarcely feasible, seeing how keenly they appreciate newly-invented manures (*e. g.*, superphosphate, alkaline nitrates, etc.), new implements, new methods of subsoil drainage, etc.

Men began to suspect one of two things, either that there was (*a*) some obstacle to the agricultural use of sewage; or (*b*) that its theoretical value was very far from being its practical worth.

But other facts than those adduced by the mere working farmer, presented themselves in the failure of the farming attempts of enthusiastic irrigationists. Despite the statement of Mr. Edwin Chadwick, who, in 1844, propounded his views with the authority of the Board of Health, that liquid manure was at all times preferable to solid manure, and suitable for all crops and all soils, we have to record one long series of miserable failures in the attempt to find experimental proof of theoretical estimates. The failure of Mr. Smith's farm (Deanstone), of Mr. Neilson's farm, of Mr. Telfer's farm, of Mr. Kennedy's farm (Myremill), of Mr. Huxtable's farm, of Mr. Chamberlain's farm, of Mr. Littledale's farm, and of Mr. Mechi's farm (all of which cases have at various times been held up as wonderful illustrations of the money success of irrigation) supply the unanswerable answer to Mr. Edwin Chadwick and his school.

The Rugby farm was pronounced "unremunerative" by its first manager (see Mr. Campbell's letter, *Times*, November 18, 1864), whilst it was abandoned by Mr. Congreve, and by Mr. Walker who succeeded Mr. Campbell. The story of one and all sewage-farms is a history of commercial failure.

The irrigationists, however, still pointed those who doubted the commercial success of sewage farming to the Craigentinny meadows in Edinburgh. We were told (correctly, no doubt), that in good seasons £20 to £30 worth of green produce had been realized per acre (say £25 average). But it is no secret,

(1) That in these meadows the quantity of sewage used has been from 10,000 to 13,000 tons per acre, in other words, taking the produce as worth £25, the sewage employed had a value, irrespective of rent and farming expenses, of less than ½*d.* a ton.

(2) That the sewage was not used continuously, and when not wanted on the land, was diverted into the sea.

Nothing is more certain than that the theoretical value calculation of sewage, based on the supposition that the manurial elements of a sewage, extracted and dried, are their value in solution must be regarded as an extravagant dream of enthusiasm. Such calculations have entirely overlooked the effects of dilution, and the presence of a mass of worthless material. Nay, more, the "profligate associates," as they have been called in sewage, are not merely worthless, but worse than useless. Sewage in this respect is not singular. Thus whilst rotten farmyard manure may have an estimated value of 15*s.*, its practical value rarely exceeds one-half its theoretical. No doubt the enthusiasts of a few years ago have learnt a lesson at some cost. Mr. Bailey Denton, admitting the fallacy of old calculations, still clings with praiseworthy consistency to some of his old ideas of value. "Even," says he, "with such a greatly diminished value (*i. e.*, 1¾*d.* to ½*d.* a ton), the country has a valuable property which it is our duty to preserve."

We are constantly reminded, moreover, of the success of irrigation in India, Egypt, Persia, etc. The simple application of water to the soil in dry and warm climates increases fertility. Moreover, we must admit that sewage has a higher manurial value than mere water. But the cases are not comparable; a climate having the temperature of our own with frequent rain (rain falling 150 days, on an average, out of 365), is not to be compared with one of tropical heat and of long-continued drought. The sandy soil of Gennevilliers or of the Dantzic farm are no cases in point. Admitting as a fact a certain manurial value in sewage, the English farmer, it is certain, would sooner sacrifice the manurial value than be compelled always to have the water. For two difficulties stares him in the face (and a sanitary authority demands these conditions), first, to be compelled to take the sewage at all times (day and night, Sundays and week days) all the year round (summer and winter) whether his soil wants it or not, or whether he has any crops or not that can profitably use it, at all stages of their growth, seed time and harvest, and, secondly, so to utilize it as to produce an effluent which at all time, all the year round, shall neither produce a nuisance, nor pollute a public watercourse. In times of frost — during the heavy rains of spring and autumn — the farmer finds he has no alternative (his land being practically impenetrable) but to let the sewage pass away unpurified into the nearest stream. He finds, too, that the use of sewage again is prejudicial during the maturity and ripening of the crops. These difficulties were grasped by the Parliamentary Committee of 1862, who reported, that "it was desirable that those using sewage should have a full control over it, so that they might apply it when and in what quantities they may require."

Local authorities have, indeed, learnt the truth of these statements, since when they adopt an irrigation scheme they know that it is necessary for them to acquire land, and not trust to the farmers in the neighborhood.

I am aware that the difficulty of frost is supposed to be met by the increased temperature of the sewage. If time, however, be allowed for the ground to be aërated, and the weather be so cold as to freeze it, some of the sewage at least must flow over frozen ground. This is the dilemma. Adopt means to aërate your ground, and it will become frozen. Neglect to aërate your ground, and it is useless, or practically so. The difficuly of storm-water is said to be met by a certain portion of land being kept for storm sewage, and possibly planted with osiers. But this does not meet the case. Your osier beds can become water-logged as well as your farm. It is no doubt an advantage to have a reserve, but it only meets a part, and a very small part, of the real difficulty.

In considering the question of working cost, quite apart from the expense of preparing the land, it is stated on good authority (Local Government Board Report, p. 33) that sewaged land requires more horses and double the amount of manual labor than ordinary arable land. This means greater capital. "To properly stock (I am quoting from the report) and work a sewage-farm upon which the main produce is consumed, quite five times the usual amount of money will be needed."

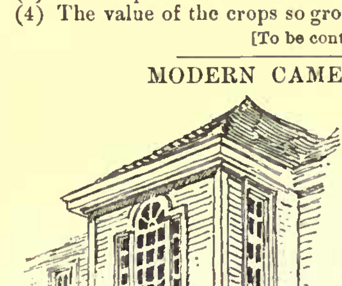
There is another point to be recorded, the enormous care needed in the management of a sewage-farm. Dr. Carpenter understands this when he laments "how mischievous people often break down the carriers and other works, and let the sewage run where it ought not to go — in that way, getting into the effluent water."

We have admitted a certain manurial value in sewage. Before we proceed to consider the question of producing a good effluent, some other points bearing on its fertilizing powers come before us, viz.:

(1) The methods of applying sewage to land.
(2) The soil best suited for irrigation.
(3) The crops most suitable for a sewage farm.
(4) The value of the crops so grown.

[To be continued.]

MODERN CAMEO CUTTING.



THE substance of which a modern cameo is made is a piece of sea-shell. Every one must have noticed that while the outside of many shells is rough and unseemly, the interior is perfectly polished, and often of a brilliant color. If the shell be broken, the way in which the two layers lie upon and pass into each other may be clearly seen. The species used by the trade will be described farther on, but we may here premise that they are chosen on account of the thickness and hardness of the layers, of the contrast of color between them, and the presence of knobs on the exterior surface which render it possible to work in relief.

When a cameo is begun, a piece of the shell, rather larger than the ornament is intended to be, is cut out and affixed to a wooden holder by means of a substance which looks like a coarse kind of sealing-wax, and seems to the touch as firm as stone, but at once yields to any high degree of heat. The inner surface of the shell is of course the lowest, and on the gray outside the master draws a rough outline of the design, and places the work in the hands of an apprentice, who reduces the knob by means of a file to the requisite height, and with the same instrument removes all the gray matter that lies outside the boundary lines, and dresses the whole of the irregular surface. In this condition a cameo

looks like an irregular piece of chalk rising out of a small plate of colored glass. It is now returned to the master, who again draws the design in pencil upon it, but more carefully this time, as the places in which the dark background has to be seen through the white mass must be indicated; and from him it passes to another apprentice or workman who has already learned the use of the *bulino* or burin. This is an instrument which is present in at least twenty forms in every work-shop of importance. The coarser almost resembles a stone-cutter's tool; the finer are nearly as delicate as those used by an engraver. Thus, from the beginning to the end, the work is always submitted to the master's eye, and always passes into more skilful hands, until he himself adds the finishing touches.

It has of late years become the fashion to have cameo portraits taken. This form of art is chiefly patronized by the Americans. When such a portrait is made, the whole work, except the mere filing down, is usually done by the master's own hand. The likeness may be taken from a photograph, but the cameo-cutter greatly prefers a study from life. As a rule, he demands three sittings, of about a quarter of an hour each. In the first, he makes a general outline of the face; in the second he adds dignity, loveliness and expression; in the third he adds or corrects details. It must be confessed that these likenesses are often striking, always clever, and generally abominable. All the resources of the master's art somehow fail to make Brother Jonathan look like a Greek hero, and, as the cutter has some classical hero always in his mind, his work is apt to become an unconscious satire. We speak of Brother Jonathan, but must confess that John Bull and his wife are not free from the same vanity. The British matron considers such portraits exquisite; they are for her the criterion of all art, the *ne plus ultra* of truth and beauty, the touch-stone by which to test good taste; but we cannot defer to her opinion.

The great fault of most modern cameos is an excessive fondness for detail. The more labor that is spent upon a piece the more valuable it becomes. Besides this, the master takes a pleasure in the exercise of his skill; he is proud of showing his work through a lens and pointing out the fineness of the single lines, and the perfection of the whole execution. This exactly suits the taste of many of his best customers, and so the general purpose of a design is often hidden under a crowd of minute felicities. It is because the Neapolitan workmen are comparatively free from this fault that their work ranks so highly as it does; but even they fall into it at times, especially in their portraits, the cheapest of which are usually also the best.

The shells used by the cameo-cutter are of three kinds. The most valuable, *Casis tuberosa*, is known in the trade as *Conchiglia serpentina*. When the shell is perfect, the external layer is of a spotless white, while the lower one seems at the first glance to be black; it is in fact of a dark gray tint, something like unpolished steel, with brown reflections. But such specimens are exceedingly rare, as much as twenty-five francs being sometimes paid for a single one. In imperfect examples, the white layer is either too thin, or is spoiled by yellowish spots, while the black one is wanting in thickness and hardness. These shells are bought by the hundred at the price of from six to eight hundred francs. About a third of the number are worthless, while only single parts of many of the rest can be used, and then only for inferior articles. — *London Saturday Review.*

COMMUNICATIONS

APPLICATION OF THE MARKING SYSTEM TO SPEECH.

WASHINGTON, D. C., November 3, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I read with interest in No. 566 of the *American Architect* your remarks on the system of points devised by the *Société Centrale des Architectes de Belgique* to assist committees in judging of the relative merits of architectural drawings submitted for competition. This system resembles very closely that in use by the United States Civil Service Commission for marking candidates for government positions; in fact, there are many special applications of the idea which you can readily call to mind. However, the first person whom I know who proposed to apply this system to general use was a distinguished officer of the Corps of Engineers, U. S. A., and more than thirty years ago he claimed it as his own discovery, and described it in a magazine article under the title of "A new system of English grammar." He explains it as follows:

"This system is exceedingly simple and easily explained in a few words. Let us represent by the number 100 the maximum of every human quality — grace, beauty, courage, strength, wisdom, learning — everything. Let *perfection*, I say, be represented by 100, and an absolute minimum of all qualities by the number 1. Then, by applying the numbers between to the adjectives used in conversation, we shall be able to arrive at a very close approximation to the idea we wish to convey.

"Let this system be adopted into our elements of grammar, our conversation, our literature, and we become at once an exact, precise, mathematical, truth-telling people. It will apply to everything but politics; there, truth being of no account, the system is useless. But in literature how admirable! Take an example: As a 19 young and 76 beautiful lady was 52 gaily tripping down the sidewalk of our 84 frequented street, she accidentally came in contact — 100 (this shows that she came in close contact) with a 73 fat, but 87 good-humored looking gentleman, who was 93 (*i. e.*, intently) gazing into the window of a toy-shop, Gracefully, 56, extricating herself, she received the excuses of the 96 embarrassed Falstaff, with a 68 bland smile, and continued on her way. But hardly — 7 — had she reached the corner of the block ere she was overtaken by a 24 young man, 32 poorly dressed, but of an 85 expression of countenance, 91 hastily touching her 54 beautifully-rounded arm, he said, to her 67 surprise:

"'Madam, at the window of the toy-shop yonder you dropped this bracelet, which I had the 71 good fortune to observe, and now have the 94 happiness to hand to you.'

"(Of course, the expression '94 happiness' is merely the young man's polite hyperbole.)

"She thanked him, and with a 57 deep blush, and a 48 pensive air, she turned from him, and pursued, with a 33 slow step, her promenade."

"P. S. I regret to add that having just read this article to my wife, and asked her opinion thereon, she replied that 'if a first-rate magazine article was represented by 100, she should judge this to be about 13; or if the quintessence of stupidity were 100, she should take this to be in the neighborhood of 96.' This, as a criticism, is, perhaps, a little discouraging, but as an exemplification of the merits of my system it is exceedingly flattering. How could she, I should like to know, in ordinary language, have given so *exact* and truthful idea? how so forcibly expressed her opinion (which, of course, differs from mine on the subject)?

"As Dr. Samuel Johnson learnedly remarked to James Boswell, Laird of Auchinleck, on a certain occasion, 'Sir, the proof of the pudding is in the eating thereof.'"

The author of the above was Lieut. Geo. W. Derby, Corps of Topographical Engineers, U. S. A., and the article appears in his book "*Phœnixiana*," now, unfortunately, out of print, which contains much valuable and interesting information on a variety of subjects.

Respectfully yours, D. P. HEAP.

A WARNING TO EXHIBITORS AT THE PARIS *SALON*.

PARIS, October 22, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Permit me to bring to your notice an affair, of which a considerable number of architects having exposed in the Paris *Salon*, have for some years past been the victims.

The publishers of a monthly journal, known as the *Recueil d'Architecture*, which journal has, I believe, a more or less extensive circulation in the United States, have the custom of selecting among the divers works exposed at the *Salon*, and of obtaining the permission of their authors to publish the same in the above-mentioned journal, with the assurance that the original shall be restored to the owners in a few days.

The recompense generally offered is a single lithographic copy. My personal experience, which is only one of the many who have fallen into the trap, was that, after several fruitless demands for the restorations of my drawings, I was obliged to resort to legal proceedings in order to obtain them, which I finally did, some three months after the close of the *Salon*.

By way of recompense, I received a very insulting letter from the publishers, who, nevertheless, continue to publish the designs *under their own name*.

I hope you will kindly give this place in the columns of your journal, in order that any American who exposes in the Salon in future may be warned to protect himself against such knavery.

Very faithfully yours, JAMES ACKERMAN.
Architect.

NOTES AND CLIPPINGS

THE CATHEDRAL OF MALTA. — Of course, one of the chief attractions in Malta is the grand old Cathedral of St. John the Baptist, and I must confess that, as with other things of which we have heard high praise before seeing them, the first impression was disappointing. I entered St John's at the hour of vespers and felt chilled. There was a very small, inattentive congregation. Two men who sat close in front of me (poor tradesmen), were discussing their worldly affairs so audibly that an acolyte was sent down from the altar steps to silence them. The architecture seemed to me stiff and cold. It was not till I returned to Malta, on my homeward route, and had spent delightful weeks under the stone roof of the old Grand Masters, that, overshadowed by their spirit, I could realize something of the poetic beauty of their old cathedral and learn to tread with more reverence on that sacred pavement, because each stone is emblazoned with heraldic devices, or other memorial, of some brave warrior who knelt here at his devotions and now sleeps in the crypt below. But for this association, the pavement of Pietra Dura, in oblong compartments (in memory of divers knights), is very like a great piece of patchwork, and the effect of those inlaid marbles lack repose. All round the great church are side chapels, where the knights of each nation worshipped together. These, like their eight palaces, or, rather, *auberges*, were set apart for the knights of France, Provence, Auvergne, Arragon, Castile, Italy, Germany and Anglo-Bavaria. Each chapel, of course, has its great altar and crucifix,

before which some worshippers are always kneeling, heedless of passers-by. There are second-rate pictures and heavy monuments without number. Of these last, by far the most attractive to me is the beautiful statue of Comte Beaujolais, a name endeared to me by old family ties. The cathedral is said to have been formerly very wealthy, but the French stole great quantities of gold and silver plate and jewels from its treasury. Among other thefts was that of a most precious relic, namely, the right hand of St. John, which had been presented to the Grand Master by the Church of Santa Sophia, at Constantinople. A magnificent diamond ring was transferred by Napoleon from the skeleton hand to his own, and the relic was then restored to the Grand Master, who, being no longer able to give it honor due, sent it to Paul, Emperor of Russia, who built a church over it at St. Petersburg. Nothing escaped the rapacious invaders. — *N. Y. Times.*

The Cost of Cremation. — According to a report read at a recent session of the Berlin Cremation Society, the minimum cost of the incineration of a Berlin "subject" at Gotha amounts to 430 marks, exclusive of church fees, singing, bell-ringing, mourning-coaches and urn. An urn may be deposited, free of expense, in the columbarium for twenty years, at the expiration of which term its safe keeping is to be paid for, or the urn will be properly interred, unless otherwise disposed of by the relatives. If the incinerated remains are to be interred in a Gotha cemetery immediately after being cremated, such interment must be paid for like any other; they may, however, be taken away in a tin case by the family, if so desired. The quantity of coal required for an incineration, as included in the fore-mentioned specifications, is 2½ tons at 20 marks each; if several incinerations take place on the same day only 1½ tons are charged after the first.— *American Register.*

Wire and its Uses. — We directed attention some time since to the increasing importance of wire in various directions. One of the electrical engineers, in speaking to the same point, indulges in the following language: "In no part of economy are we divorced from wire. It is our slave, and an ever-present master. Sleeping, we repose on wire mattresses. Eating, we see food which has passed through sieves, and which is sheltered from insect appetite by wire covers. Calling, we pull wires to ring curled-wire gongs. Travelling, we are conveyed by cable or electric railways, hoisted by elevators hung on wires, and hurried over wire bridges. We announce our coming by telegraph or telephone wires, and we tread our way by night through streets lighted by means of electric cables. Across our fields are strung thousands of miles of barbed wire. Our clocks are set by wires, our watches run by wires, our books are stitched by wires, our pictures hung by wires, and our politics managed by wires. Forty years ago there was not a telegraph office in existence. To-day they number over 60,000. Ten years ago the telephone was not in existence. To-day there are 330,000 in use in the United States alone." — *Metal Worker.*

The Statue of Joseph Brant. — The statue of Joseph Brant (Thayendanegea), which was unveiled at Brantford, Ontario, on the 13th ult., is by Percy Wood. Brant stands erect, with his head turned toward the left shoulder, a tomahawk poised in one hand, as if he were alluding to it, and the other hand at his side, with fingers spread in gesture. He has an eagle feather in his hair and rings in his ears, a buckskin coat with broad sash, buckskin trousers and moccasins. A long cloak, fringed about the neck with bears' claws, hangs from his shoulders and rests on the pedestal. The latter is square and has two groups of three Indians each; those that stand reach to the level of Brant's feet. The statue was made from cannon granted for the purpose by the Canadian Government, and is nine feet high. The six flanking figures represent the Mohawk, Tuscarora, Oneida, Seneca, Onondaga, and Cayuga nations, typified respectively by a scalping knife, spear, pipe of peace, bow and arrows, club and flint-lock gun. The bear, wolf and tortoise, tokens of the chief clans, are also represented. On the two broad sides of the pedestal are trophies of Indian weapons and implements of the chase, while about the base are two large, bronze bas-reliefs, representing fifteen Indians in a dance and Brant addressing a meeting of chiefs. Of the $16,000 which this, the first monument undertaken in honor of an Indian, has cost, $5,000 came from the Six Nations, $5,000 from the Dominion, and $2,500 from the Provincial Government, the rest being added by individuals, the county of Brant, and the city of Brantford. — *Boston Transcript.*

Water-gas Fuel. — A large number of the various schemes for utilizing waste fuel in its different forms, to which prominence has been given within the last three or four years, have had in view the production or fuel-gas of some kind, principally water-gas, and it is to this latter, therefore, that special attention has been given. Even cursory examination, however, of the principals involved in some of these undertakings have demonstrated in a most conclusive manner that the requirements of water-gas manufacture are not generally so well understood as might be supposed, and the result has been that either those who had financial interests at stake suffered more or less heavily, or there was a collapse before opportunity had been given to the originators of such enterprises to successfully practise any great amount of deception. It may not be amiss, therefore, to briefly point out again, even in the absence of anything new or startling, some of the main features of the water-gas process. Water, as is well known, consists of hydrogen and oxygen combined in the proportion of two of the former to one of the latter. These gases have a great affinity for each other, and readily combine if, when mixed in the proper proportions, a light be applied to them. If, however, the mixture be highly heated throughout, no combination will take place. The precise point at which this result occurs, known as the temperature of dissociation, has not been certainly determined, though it is generally accepted as being between 3,000° and 4,000° Fahrenheit. There is reason to believe that the more highly the gases are heated below this point the less is the affinity which they have for each other. Thus, at a temperature of about 2,000° the affinity of oxygen for carbon is much greater than its affinity for hydrogen, and if, therefore, a current of steam be passed through a coal fire, the steam will be decomposed, the oxygen will go to the fuel, and the hydrogen will be set free, the result being a mixture of carbonic oxide and hydrogen, quite free, or nearly so, from nitrogen. The process is so simple and the economies ascribed, among other things, to the gain of hydrogen are apparently so great that the favor with which this method of gas manufacture has been received is not difficult to explain. Yet practically there are some drawbacks connected with it which make it appear in a less favorable light. The work done in dissociation cannot be performed without some loss of fuel beyond that theoretically necessary, and the hydrogen cannot be recombined or burned so as to give out its full effect, representing a waste of energy not to be overlooked. Convenience, however, is a point which may well be urged in favor of using some kind of fuel in the gas form, and to it there is reason to look as a cause of much development which may be recorded in this line of manufacture. — *Iron Age.*

TRADE SURVEYS

The latest summary of building-trade statistics in seven of the larger cities exhibit a rather surprising activity and a very gratifying outlook for the coming six months. The greatest general activity in building is exhibited throughout the West and Northwest. In the city of Chicago the value of permits for the first nine months of this year was $15,953,950 against $13,770,130 for 1885. The value of the permits of last week against the previous week's permits is nearly double. The building statistics of St. Louis exhibit a smaller increase, but at the same time a very gratifying one. In Kansas City, Omaha, Duluth, St. Paul and Minneapolis, the increase in permits and in their value certainly points to an active winter, and a more active spring. Building material of all kinds is very firm in prices and in numerous cases contracts have already been entered into for building supplies for the spring. There is also an encouraging degree of building activity in a number of manufacturing and business enterprises between the lakes and the Ohio Valley. Reports from Springfield, Joliet, Indianapolis, Columbus, Cincinnati, Toledo, Cleveland and from the manufacturing strip along Eastern Ohio, as well as from Wheeling, Pittsburgh and from Central Pennsylvania, all justify the general and safe conclusion that an extraordinary amount of preparation is being made for building for the coming season. A great deal of the activity will be in manufacturing. There is an urgent demand for more capacity, in iron and steel making, in glass-making, wagon and carriage making, tool and implement manufacturing, and, in fact, in all the industries connected directly or indirectly with iron and steel using. The building-trade conditions farther East are sufficiently familiar. The local building authority in New York city furnishes statistics showing that 3704 buildings have been planned in that city between January and October, costing $53,119,068, against 2874 buildings last year costing under $40,000,000. The total number of conveyances is put at 11,242 against 9,195 for same time last year. The corresponding amounts of money are $201,826,369 and $149,511,513. The number of mortgages recorded in New York city are stated by the same authority to be 10,150 as against 8,433 for same time last year, representing in round numbers $117,000,000 and $86,000,000 respectively. The building statistics of Philadelphia exhibit a similarly active condition in house-building, manufacturing, and shop-building, and in real-estate transfers. Real estate throughout Pennsylvania has been in active demand, and authorities there state that the sale of lots for building purposes to people able and intending to build has been far in excess this year of any previous year. The same activity is found to exist in Western Pennsylvania. A great deal of manufacturing capacity is seeking sites there, attracted by the economical advantages of natural gas. A vast amount of house-building is projected by local capitalists for the coming year. Rolling-mill capacity is being increased. New mills and furnaces are either projected or under way. The entire natural-gas region will, it is evident, become the greatest manufacturing centre upon this continent. Through Ohio, especially within reach of the natural-gas region, there is a great deal of new building projected. The Ohio Valley is maintaining its prestige as a manufacturing region, but the greater part of the new enterprises are small concerns involving an expenditure of $5,000 to $100,000. It is probable that there will be no serious advance in iron and steel or in their products. While trouble is probable in the building trade it is scarcely possible in the iron trade. The two classes of mill-labor are controlled by yearly contracts, one which expires in January and one in June. All kinds of iron and steel are high and firm in price, but prices are not likely to be jeopardized by any speculative influences.

The distribution of all kinds of lumber has been remarkable. Mills in the Northwest are, in numerous cases, operated day and night to accumulate stocks sufficient to meet the requirements which the development of the past two months have shown to be necessary. Freights have been advanced both by lake, rail and coastwise. Dealers have advanced quotations correspondingly, and buyers are still making haste to cover winter requirements. No scarcity is probable. Saw-mill capacity in the Northwest and South has been largely increased and presumably, therefore, the future supplies will be greater. Lumber manufacturers have been hopeful all along that the cut now nearly over would not crowd the market. It is only the extraordinary demand which keeps prices at anything like remunerative limits. The industrial situation generally is strong. Fuel is in active demand, shop-capacity is oversold, capitalists feel more inclined to extend their investments in industrial directions, and in view of the general activity and strengthening of prices. The wonderful expansion going on North and South will meet the extremest requirements of the country. Foreign and steel markets are improving, and large orders are now in hand for rails, blooms, billets, crude iron and other products. The American rail-makers have sold one-third of their producing capacity of next year, and the car and bridge builders are hurrying in orders. Both at home and abroad the industrial revival is significant. The activity abroad means higher prices here next year.

The labor question continues to occasion distrust. Employing interests desire a settlement of wages during the winter, yet they do not feel inclined to ask their employés to meet them for that purpose. Organization among employers is growing in many industries. The compacts made have been maintained and are restoring confidence. The unfortunate eight-hour strike at Chicago revives distrust as to the probable future course of the Knights of Labor, but employers generally have faith that so far as that organization is concerned there will be no official recognition or aid given to a general movement to that end.



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STAIRCASE IN THE HOUSE OF THE LATE HENRY W. LONGFELLOW, CAMBRIDGE, MASS.

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CONTENTS

IT seems that the law which was passed a year or more ago in New York, limiting the height of dwelling-houses to a maximum of eighty feet from the sidewalk, has, like so many others of the statutes which we pay our legislators for composing, proved a dead letter. It is not quite settled yet whether it was born dead, or died immediately after birth, but it is certain that it never showed any signs of life, and some doctors in the law assert that it never possessed the organs necessary to vitality. According to these learned men, the statute neither contained any provision for its own enforcement, nor mentioned any penalty for its violation; while, even if it had been fortified by these weapons, it was plainly unconstitutional, since it undertook to limit men in the enjoyment of their real estate, which, in legal theory, extends from the surface of the ground on which its boundaries are drawn to that heaven where titles and taxes have no place; and moreover, even if it had been originally constitutional and vigorous, it was repealed immediately after its passage, by the passage of the General Building Law of 1885, which contains precise provisions for the thickness of walls in dwelling-houses more than one hundred and fifteen feet high, under the rule that a subsequent statute abrogates and repeals all provisions inconsistent with it which may be contained in those previously existing. We have our doubts as to the unconstitutionality of laws restricting the height of buildings, but our readers will observe that a law which never had any life in it, nor possessed any vital parts, and which could not exist, if it had possessed them, in the pure, constitutional atmosphere of New York, and which, moreover, was killed immediately after it was born, need have no great terror for them, and, in practice, the people who wish to do so build houses a hundred feet high or more with just as much freedom as they did before the statute was passed. Fortunately for the people of New York, the lofty apartment-houses once so popular are coming into disfavor. Their great cost, as compared with that of humbler structures, made them doubtful investments in any but the most fashionable localities, and the infirmities of construction which some of those more carelessly or ignorantly designed have displayed, perhaps cast discredit on the rest, so that a twelve or fifteen-story flat in a second-rate situation in New York is just now not a very desirable piece of property to own, and it will be many years before the fever for building them comes on again.

VAN NOSTRAND'S ENGINEERING MAGAZINE adds a little to our knowledge of the properties of steel by means of three articles, two quoted from the *Engineer*, and the other from *Iron*. The first two are devoted to the consideration of the effect produced upon steel by working at black heat. According to these, a large part, at least, of the "unaccountable" failures of steel plates and bars, which, as it says, have caused many engineers to regard steel as "a treacherous material," are found to have been due to the bending or hammering of the metal while at a "blue" or "black" heat. "It should by this time be known," one of the articles continues, "that this is the most injurious treatment to which steel can possibly be subjected," and the effect of the same treatment on ordinary iron is somewhat injurious. To obtain some definite data on the subject, three hundred and thirty experiments were made, in which plates of moderately hard steel, of mild steel, of very mild steel, and of Lowmoor iron — the best and purest in commerce — were repeatedly bent, until they broke, some of the samples undergoing all their bending while cold, and the others being first bent once while at a black heat, and again after cooling. The pieces bent without heating did not differ very greatly in their flexibility, as shown by the number of bends that they would bear before breaking. Strangely enough, the mild steel samples were the least ductile, usually breaking, if bent without any heating, about at the thirteenth bending, while the very mild steel bore twenty-six bendings, the Lowmoor iron twenty, and the moderately hard steel twenty-one. If, however, any of the steel plates were heated to a point below redness, and then bent twice, they lost their ductility so completely that three-quarters of them broke with a single blow of a hammer, while three only, out of twelve samples, retained ductility enough to bear one or two subsequent bends. The Lowmoor iron, though injured by the bending while hot, was much less affected than the steel, and, after two bendings while hot, still retained ductility enough to be bent ten times more before it broke.

WHEN only one preliminary hot bend was given, the Lowmoor iron could be bent twelve times subsequently before breaking, while the very mild steel bore eleven bendings, the moderately hard steel three, and the mild steel two, or a fraction more; or, stated in another way, a single bending while hot deprived the iron of two-fifths of its ductility, the very mild steel of three-fifths, the mild steel of five-sixths, and the harder steel of six-sevenths. It must be remembered that these experiments were made with steel so lightly carbonated as to be naturally softer and more ductile than the purest commercial iron, so that, as the result of the experiment shows, all the steel plates bore bending while cold better than the iron, yet bending twice while hot, while it only diminished by one-half the ductility of the iron, rendered the steel samples so brittle that nearly all of them broke, almost like glass, at the blow of a hammer. The account says that it still is a common practice among boiler-makers to heat plates before hammering or bending, "to take the chill out," but that since scientific engineers have recognized and pointed out the danger of doing so, it is becoming the rule in some of the best shops to stop all hammering or bending of steel plates as soon as they have cooled down so far from a red heat that a piece of wood rubbed over them no longer leaves a glowing mark. This rough test seems to distinguish the condition of redness, in which either steel or iron can be wrought with safety, from the blue heat in which any hammering or bending is followed by the most serious consequences. Probably better tests than this will be devised before long, but in the meantime it is impossible not to suspect that there may be a connection between these results of what we are told is a common practice among boiler-makers and some singular failures of steel structures. We are not yet convinced that the loss of the *Oregon* may not have been partly due to some such condition of its plates, which served to increase in a moment a comparatively small injury into a fatal lesion; and the bursting of the Gravesend water-tower, which is as yet unexplained, may well prove to have been the result of some injudicious treatment of the steel plates of which it was built.

A FEW months ago there seemed to be nothing in the composition or structure of mild steel, as distinguished from iron, to account for this singular difference in their behavior under similar conditions of heating; but some examinations have recently been made at Creusot in France, by MM. Osmond and Werth, the results of which indicate that there is much more difference in texture between the two materials than has hitherto been suspected. Nearly all the treatises on the subject speak of wrought-iron as a fibrous mass of elongated crystals of more or less impure metal, generally adhering by their sides, but often separated by fibres of slag which had not been worked out in rolling or hammering; while cast steel, of the modern mild sort, is described as a homogeneous mass of nearly pure iron, containing a minute quantity of carbon in

solution. MM. Osmond and Werth, however, by placing very thin sheets of cast steel on a glass microscope slide, and covering them with nitric acid, found, as the metallic iron dissolved in the acid, that a cellular skeleton was left, composed of insoluble carbon, so distributed as to show beyond question that this sort of steel, instead of being a uniform solution of carbon in iron, is composed of an aggregation of cells of carbonate of iron, filled with soft iron, which contains no appreciable amount of carbon. By trying in this way different samples of steel, it was found that a similar cellular structure existed in all, but that in the metal from the ingot the cells were comparatively large, while remelted and wrought steel showed them small and much broken up. It would be difficult to connect at once this structure of mild steel with its behavior when worked while at a certain temperature, or when punched or sheared, but it seems by no means unlikely that there is a close relation between the two things, and it would be in every way desirable to have MM. Osmond and Werth's experiments, which are by no means difficult, repeated and extended wherever scientific metallurgy is studied.

M. EMILE TRÉLAT, the distinguished architect and writer on professional topics, sends to *Le Génie Civil* a most instructive essay on the lighting of rooms in dwelling-houses, with regard to the health of their inhabitants. It is unnecessary to say that, like all modern writers on the subject, M. Trélat regards light as an important factor in maintaining health, and thinks that rooms should be so constructed as to admit much more of it than is now usually the case. The physical effect of ample light is, as he says, to increase the action of the skin, and with it that of the lungs, while it nourishes and refreshes the nerves; and the effect of living in rooms insufficiently illuminated is to depress the spirits, to weaken the eyes and the lungs, and to render the skin pale and inactive. Physicians understand this well enough, and prescribe for their patients with depressed spirits and feeble nerves, regular and full exposure to the sunlight; but it is the habit of physicians to say little about matters beyond their control, and if they cannot get their patients out of doors, or into the sun-bath of a hospital, they content themselves with making the best of such windows as they find, without giving directions for altering them, or making over new the house in which the patient lives. With architects, however, who can direct the arrangement of new structures, the case is different, and they may with profit keep in mind the most favorable disposition of openings in this respect. In general, as most architects know, the brightest light comes from the zenith, and the amount of light which a window of a given size will admit into a room depends mainly upon the height above the horizon from which it receives its rays. According to Gwilt, an opening in the ceiling of a room admits ten times as much light as an opening of the same size in the centre of the side of the same room. M. Trélat does not give the proportion in the same way, but asserts that "the general rule for good lighting is to raise the head of the window to the greatest possible height." Especially is this necessary for rooms on courts or narrow streets, where nearly all the light which enters them must be obtained by reflection from the buildings on the opposite side of the street. As M. Trélat earnestly says, "the smallest ray from the zenith, if it succeeds in squeezing through the window into the room, pours into it a direct light a hundred times superior to the gray light reflected from the opposite wall," and it is surprising that although we all acknowledge in theory the truth of this, nine-tenths, probably, of the windows in our city dwelling-houses and office-buildings are set from one to two feet below the ceilings of the rooms which they are intended to illuminate, so that the direct light from the sky, which might easily have been admitted to all parts of the room, finds its way only, in the best cases, to a small area directly about the window-sill.

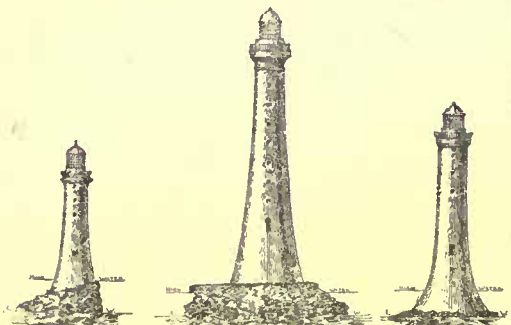
IF the window heads are carried within a few inches of the ceiling, as they should be, a sufficient amount of light, for rooms of the ordinary shape, is usually obtained by making the window-area one-fourth that of the wall in which the windows are placed. Perhaps a better rule, since it provides for rooms of all shapes, is that which requires that the window area shall be one-sixth that of the floor of the room, but for most cases the two rules would agree quite closely in their results. Having secured openings of the requisite size, properly placed, the architect, or the householder who wishes to have no nervous sufferers in his house must next see that the light which he has arranged to bring in is not shut out again by curtains or draperies. It is unnecessary to say that the ordinary upholsterer's pattern of window curtains cuts off about nine-tenths of the light which would otherwise willingly enter through the opening. The valance, or heading, which decorates the top of the draperies, has most to answer for, since it intercepts permanently the upper rays, but the lower portions, which are usually drawn back by a cord near the bottom, shut out nearly all but the horizontal rays; and even where circumstances prevent the use of drapery curtains, heavy painted or dyed shades are almost always kept drawn over the window, at least as far down as the meeting-rail of the sash, cutting off perhaps five-sixths of the light. M. Trélat, who complains bitterly of the "ruin" caused to the proper lighting of rooms by the ordinary disposition of curtains, which, as he says, is perfectly contrived for making rooms gloomy and dim, gives an illustration of window curtains sliding on a pole, like a portière, or the little silk curtains now often used over windows, which he regards as much better than the old-fashioned upholsterer's pattern; and with these, supplemented by semi-transparent shades, for shutting out too strong sunshine, a room may be so managed, as he says, that its inhabitants shall find themselves always within the salutary influences of the light, without being exposed to discomfort from rays of too great force.

L'ELECTRICIEN contains an extraordinary account of some experiments in hypnotism, in which a telephone was used, with the idea of seeing whether ideas could be communicated to a hypnotized subject through this instrument, without the aid of the personal influence of the operator. The hypnotism of the account is similar to what is known here as mesmerism, and the hypnotic state, like the mesmeric state, is brought on in susceptible persons by the mere effort of will of another person, but in other cases by directing the eyes steadily toward any bright object placed in front of them, and so far above them that it can only be seen by turning the eyes upward as far as possible. A few minutes of this exercise usually throws the patient into a condition of insensibility, in which, however, he perceives and obeys the will of one or more of the persons about him. The will of the operator can be communicated to the other either by words, or, in some cases, silently, and the intention of M. Liégeois and his friends was to see what would be the effect of interposing so material an object as a long wire between the two. With this idea a line about five hundred feet long was prepared, by making connection, through the central exchange, between a printing-office and one of the editorial rooms of a certain newspaper. A patient, or, as we should rather say, a victim, was then seated in the printing-office, with a telephone at each ear, and the proposition was made to him through the telephone that he should go into the mesmeric sleep. After two or three minutes of urging, he became insensible, still holding the telephone to his ears, and M. Liégeois then told him, through the telephone in the room, to stay just as he was until he waked him. He then walked over to the editorial office, and, taking up the telephone there, directed his patient, through the central exchange, to wake up, which he immediately did. The experiment was then repeated, and, instead of waking the patient at once, M. Liégeois ordered him, through the telephone from the editorial room, to go through various performances, such as sneezing, singing, imitating drunkenness or paralysis, and so on, all of which he did, with the obedient alacrity characteristic of a mesmerized subject. Many trials resulted in the same way, and, to judge from the account, either the telephone operators or the psychologists, or both, are likely to have some rather novel problems presented to them by those interested in following up the subject.

REPLIES to the circular which we sent to our subscribers on September 20, continue to reach us, so that we hesitate to begin the comparison and compilation of the vote for the list of "the twenty books an architect can least afford to do without." Still we can say that unless more opinions are expressed, the result will be far from conclusive, as at least ninety per cent of the books named must be classed as "scattering." If any one did not receive or has mislaid his circular we shall be pleased to send him a copy. The replies to the companion circular issued at the same time contain much interesting, and, to us, valuable information, and to this, too, we should like to receive a greater number of answers.

ANCIENT AND MODERN LIGHT-HOUSES.[1] — V.

BELL ROCK LIGHT-HOUSE.



BELL ROCK is a most dangerous sunken reef on the northern side of the entrance of the Firth of Forth, Scotland, and, consequently, a direct danger to all vessels entering the Firth of Tay. The nearest land, at Aberbrothok, is eleven miles distant.

It is uncertain how the rock came to bear its name, possibly on account of its shape, which somewhat resembles a large bell; but the tradition is that an abbot of Aberbrothok caused a bell to be erected on the rock which, by means of a floating apparatus, was rung by the motion of the waves, and that this bell was carried off by pirates. On this legend is founded the ballad of Sir Ralph the Rover, one of Southey's minor poems. It should be mentioned that in old charts this rock was called Inch Cape, or the Inch or Island of the Cape, referring to the Red Head, the highest and most remarkable on that coast.

Southey's ballad is as follows:

No stir in the air, no stir in the sea,
The ship was still as she could be;
Her sails from Heaven received no motion;
Her keel was steady in the ocean.

Without either sign or sound of their shock,
The waves flowed over the Inchcape Rock;
So little they rose, so little they fell,
They did not move the Inchcape Bell.

The Abbot of Aberbrothok
Had placed that Bell on the Inchcape Rock;
On a buoy in the storm it floated and swung,
And over the waves its warning rung.

When the rock was hid by the surge's swell,
The mariners heard the warning Bell;
And then they knew the perilous rock,
And blest the Abbot of Aberbrothok.

The Sun in heaven was shining gay;
All things were joyful on that day;
The sea-birds screamed as they wheeled round,
And there was joyaunce in their sound.

The buoy of the Inchcape Bell was seen,
A darker speck on the ocean green:
Sir Ralph the Rover walked his deck,
And he fixed his eye on the darker speck.

He felt the cheering power of spring;
It made him whistle, it made him sing:
His heart was mirthful to excess,
But the Rover's mirth was wickedness.

His eye was on the Inchcape float;
Quoth he, "My men, put out the boat,
And row me to the Inchcape Rock,
And I'll plague the Abbot of Aberbrothok."

The boat is lowered, the boatmen row,
And to the Inchcape rock they go;
Sir Ralph bent over from the boat,
And he cut the Bell from the Inchcape Float.

Down sunk the Bell with a gurgling sound;
The bubbles rose and burst around:
Quoth Sir Ralph, "The next who comes to the Rock
Won't bless the Abbot of Aberbrothok."

Sir Ralph the Rover sailed away;
He scoured the seas for many a day;
And now, grown rich with plundered store,
He steers his course for Scotland's shore.

So thick a haze o'erspreads the sky,
They cannot see the Sun on high;
The wind hath blown a gale all day;
At evening it hath died away.

On the deck the Rover takes his stand;
So dark it is they see no land.
Quoth Sir Ralph, "It will be lighter soon,
For there is the dawn of the rising Moon."

"Canst hear," said one, "the breakers roar?
For methinks we should be near the shore."
"Now where we are I cannot tell,
But I wish we could hear the Inchcape Bell."

They hear no sound; the swell is strong;
Though the wind hath fallen they drift along,
Till the vessel strikes with a quivering shock:
"O Christ! it is the Inchcape Rock!"

Sir Ralph the Rover tore his hair,
He curst himself in his despair:
The waves rush in on every side;
The ship is sinking beneath the tide.

But, even in his dying fear,
One dreadful sound could the Rover hear, —
A sound as if, with the Inchcape Bell,
The Devil below was ringing his knell.

At high water of spring tides the southwestern reef is about sixteen feet under the surface of the water, while that part of the rock on which the light-house is built is about twelve feet below. At low water of neap tides hardly any of the rock is visible, but at low water of spring tides the general level of the northeastern end, where the light-house is built, is about four feet above water, and occasional points are six feet above. Owing to the contrary tides the peculiar position of the rock and its dangerous character, ordinarily invisible, the need of a distinguishing mark upon it was early seen, and in 1793 Sir Alexander Cochrane made an official application to the Commissioners of the Northern Light-Houses, and they considered it an object of primary importance that one should be erected whenever funds should become available.

In the mean time public advertisements were inserted in the papers calling for some suitable plan. Several propositions were received. Notably Captain Joseph Brodie prepared a model of a cast-iron light-house supported on four pillars, strongly braced together. The design was not altogether approved by the Light-house Board, but the projectors had so much confidence in their plan that they erected, at different times, two temporary wooden beacons which, unfortunately, were immediately washed away.

The merchants of Leith, pleased by their perseverance, subscribed £150 toward the erection of a stronger temporary beacon, built of four strong spars, well braced and fastened with iron straps. The feet of the spars were let into the rock and also held to it by iron cemented to the rock with lead. This structure was erected with great difficulty in July, 1803. In the following December it entirely disappeared.

Mr. Robert Stevenson, the designer of the Bell Rock light-house, paid the first visit to the rock in August, 1803; as he was favored by both tide and weather he was enabled to land on the rock and remain there long enough to make a good sketch of it, during which time the boatmen devoted themselves to hunting for articles of shipwreck, and to such good purpose that before the tide overflowed they had collected a couple of hundred pounds of old metal of a miscellaneous character, among them being a kedge-anchor, a stove, a shoe-buckle, several pieces of money, a ship's marking-iron, etc.

These relics of disaster eloquently spoke the need of a light to mark this spot. The result of this visit was that Mr. Stevenson was convinced that the proper kind of tower to be erected here should be of stone in preference to the pillar form, as there was ample room for a large base, and besides, the tides rose so high that a vessel might come full sail against any erection made there — were the structure pillar-formed it might readily be damaged — but if the building were of solid stone it is not likely that the vessel would have any effect upon it.

The design was, therefore, made the same in principle as the Eddystone, and is shown on the plate. [See Illustrations.]

Various petitions were made to the Light-house Board, setting forth the danger of this rock and the great necessity there was of properly marking it, and though the Board recommended it, it was not until the year 1806 that the act of Parliament passed, authorizing its construction and appropriating a sufficient sum for its erection.

A clause had been introduced into the bill authorizing the collection of light-house duties of one penny half penny per register ton from British vessels, and three pence per ton from foreigners as soon as a ship or vessel was moored or anchored, and a floating or other light exhibited at or near Bell Rock.

In order that shipping might have the benefit of a light while the work was in progress, and also to have the benefit of the duties, a light-ship was fitted out; she was a Prussian fishing-vessel, captured by a British cruiser during the war of 1806, flat bottomed and rounded at both stem and stern; her capacity for rolling and incapacity for steering became proverbial, and later, when she was used as a storeship for the work, occasioned much trouble and uneasiness.

The first work on the rock was to clear it from sea-weed, and to trace the sites of the beacon-house and light-house on the rock; after this was done the first landing for erecting the beacon-house was made, which event was celebrated by three cheers and the regaling of each man with a glass of rum. Little work could be done the first day, but the holes for the holdfasts of the beacon were commenced, and the smith laid out a site for the forge.

The tide only allowed the men to remain two hours on the rock; when they returned on board they were variously employed in fishing, reading, drying their wet clothes, and listening to two or three companions who played the violin and German flute. They were blessed with reasonably good weather, and successfully bored all the dove-tailed holes for the iron holdfasts, and then commenced the cutting of the rock to receive the first course of masonry of the tower.

It was quite a problem as to the best method of landing the large stones for the light-house, and various plans were suggested, such as to attach a cork buoy to each stone and float it to the rock, or to use an air-tank as a float, to load the stones in light-draught, flat-bottomed vessels which could sail over the rock at high tide and drop the

[1] Continued from page 168, No. 563.

stones overboard; to build so much of the light-house ashore in a sort of coffer-dam as would raise the building to the level of the highest tide, and, having prepared the foundation to receive it, to tow the coffer-dam to its site and lower it to its place.

The method decided upon was to bring the vessels loaded with stone conveniently near the rock and to moor them, and then to transfer the stones to smaller deck boats, called praams, and to tow the latter to the rock at low tide, while the artificers were at work and ready to lay the stones in their proper positions. This method succeeded admirably; and when the first stone was landed all hands collected to welcome it and greet it with three cheers, and a glass of rum was served to each man. This formality accompanied every important step of the work. The next day after the first stone was landed, there occurred what might have been a most serious disaster. Soon after the workmen landed in the morning, the tender's boat and crew put off from the rock to examine the tender's moorings. The boat had no sooner reached the tender than the latter went adrift carrying the boat with her; as it was blowing hard it was with great difficulty that the crew could set the sails, and by the time this was done she had drifted some three miles to leeward, rendering it impossible for her to return to the rock until long after it would be overflowed.

The situation was indeed critical; there were thirty-two men on the rock, and only two boats which could carry in pleasant weather twenty-four men. For a long time the disaster was noticed only by Mr. Stevenson and the landing-master, as the men were busily employed at their respective tasks. When, however, the tide rose and the work of necessity stopped, the men went toward their respective boats, and to their astonishment found but two instead of three; no one uttered a word, the men looked at each other and at Mr. Stevenson; each man fully aware of the gravity of the occasion, and apparently calculating the chance of escape.

Mr. Stevenson had been considering various schemes by which to save the men, and attempted to address them; but his mouth was so parched that he could not utter a word; he stooped to get a little sea-water to moisten his throat, and as he rose he heard the cry of "a boat! a boat!" and on looking round saw through the haze a large boat coming toward the rock. This proved to be the pilot-boat from Abroath with letters; half the men were put on board of her, the other half took the two boats and after a hard row, for the wind had increased to a gale, arrived on board worn out and drenched to the skin.

The next morning but eight of the twenty-six workmen reported for duty, the rest had not got over their scare. When the eight returned from the rock, they saw the other eighteen on deck; but as the boat approached they went below; ashamed of their conduct. This was the only instance when the men refused to work, except the case of four Scotchmen, who would not work on Sundays.

After various untoward accidents, and a narrow escape from shipwreck of the whole party during a most violent storm the wooden temporary beacon was finally successfully erected; this was a most important proceeding, for the workmen could now safely remain at the rock all day; and the blacksmith could have his forge and bellows on a platform above the reach of the tide. When the beacon was finished, a small flag was displayed from its top "by which its perspective effect was greatly improved." The event was celebrated by three hearty cheers, and the custom of serving a dram of rum to each man was not forgotten. This closed the first season's work, and the workmen returned to Abroath. During the first season the actual working time was but thirteen-and-a-half days.

During the following winter the stones were cut to shape, and as may be seen by the plan, were dovetailed together; the outside shell was to be of granite to a height of thirty feet on the solid part of the structure; the rest of the building was of sandstone.

Various experiments were made as to the kind of mortar to be used, and it was found that a mixture of pozzolano and lime in a state of dry, impalpable powder, and clean sharp sand in equal proportions by measure, mixed with sea-water, formed a mortar equally good in all respects as when no sand was added.

Ordinarily it would have been difficult to obtain a sufficient number of good men to go on with the work, but as the men were exempt from the danger of being impressed on men-of-war, Great Britain being at war with France at the time, the work became very popular. The men were furnished with a ticket descriptive of their persons, to which was attached a silver medal having on one side a figure of Bell Rock Light-House, and on the other the word "medal." The Impress officers generally respected this.

On the 25th May, 1808, the workmen again embarked for the rock and landed; on the next day, the light-house colors were hoisted on the beacon.

The first course for the foundation of the light-house was finished at the stone-yard on the 4th June, the birthday of King George III. Work was carried on briskly at the rock, and by the 9th of June the foundation pit was completed and the first stone landed. At 11 A. M. the next day the stone, on which had been chiseled "1808," was securely placed, and Mr. Stevenson pronounced the following benediction: "May the Great Architect of the universe complete and bless this building," on which three hearty cheers were given, and success to the future operations drunk with the greatest enthusiasm.

By the 26th of July, the eighteen detached pieces of stone forming the foundation-course had been laid, and the whole surface brought to uniform level.

As the other courses when laid would be under water at high tide their weight was not alone relied upon to retain them in place, but they were also held by oaken treenails, as described in the construction of the Eddystone tower.

By the end of the season the base of the tower had been built to a level with the highest part of the foundation pit, or about five feet six inches above the lower end of the foundation stone. The men were at work during low water two hundred and sixty-five hours, only eighty of which were employed in building. During the storms of the following winter but slight accidents happened to the beacon, and these admitted of easy repair.

The first thing done the next season was to fit up the wooden beacon as a temporary residence. Work was commenced laying the stones, and by the 8th July the work was so far advanced that the high tide for the first time did not overflow the building, and the usual cheering and rum were indulged in.

On August 25 the last stone of the solid part of the building was laid, and the work on the tower closed for the season; this event also was observed with the usual ceremonies. The tower was now thirty-one feet six inches above the foundation course and seventeen feet above high water. In the next year the last stone was laid on July 30. During the year there had been various accidents and several narrow escapes, but fortunately no loss of life.

It is sufficient to show how high the waves would run up this tower, when it is stated that the men were occasionally driven from their work, even when the tower had reached the height of eighty feet. When the stonework had been completed, the tower was one hundred and two feet six inches high, and had reached the lintel of the door of the lantern. The lantern was built and glazed by the 25th of October. This closed the season's work.

Two light-keepers were left in the tower in October; the following November, when an additional supply of water and provisions were taken out to them, they were asked as to their experience. One of them stated that in storms when particular seas struck the light-house would tremble, and reminded him of the effect produced when a round log was hit sharply with a mallet, and though he had every confidence in the stability of the building, yet it "made a man look back upon his former life."

The lamps and reflecting apparatus were safely placed in the tower in December. 1810, and on the 17th of the month notice was given that on the night of February 1, 1811, the light would first be exhibited.

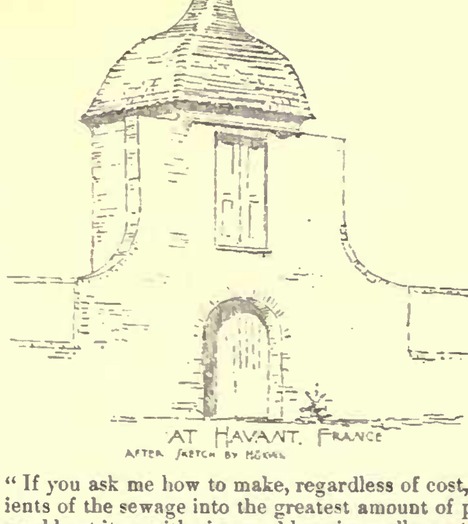
On the 30th July, 1814, Sir Walter Scott, Mr. Stevenson and several other gentlemen visited the light-house. They took breakfast in the library, and at the earnest entreaty of the party, Sir Walter, after inscribing his name in the album or visitor's book, wrote the following verse: —

Pharos loquitur. —
Far in the bosom of the deep,
O'er these wild shelves my watch I keep,
A ruddy gem of changeful light,
Bound on the dusky brow of Night,
The seaman bids my lustre hail,
And scorns to strike his timorous sail.

In conclusion, it may be of interest to state that this important structure contains 28,530 cubic feet of material, and weighs 2,076 tons.

THE TREATMENT OF SEWAGE.[1] — III.

I. — THE METHODS OF APPLYING THE SEWAGE TO LAND.



VARIOUS methods have been suggested, such as simple broad irrigation, as practised at Milan, converting the field into a water-meadow; and subterranean irrigation, pipes being laid sufficiently deep to be beyond reach of the plough. This may be called upward irrigation. Both of these plans have been tried and abandoned. Irrigation by hose and jet is no doubt that method of applying sewage which yields the best results (Smith of Deanstone, Chadwick, Mechi, Telfer, Kennedy). Professor Way says, "If you ask me how to make, regardless of cost, the manurial ingredients of the sewage into the greatest amount of produce of any kind, I would put it on with pipes and hose in small quantities almost as I would

[1] A paper by Dr. C. Meymott Tidy, read before the Society of Arts, April 14, 1886, and published in the *Journal* of the Society. Continued from No. 568, page 234.

in garden cultivation, as if I were watering it with watering-pots, but it would never pay you to do it." And, apart from this, you would never be able to get on the land the quantity that would meet the sanitary difficulty. This failing, sewage has to be brought to the highest points of the land to be irrigated, conveyed by carriers of a more or less permanent character into some form of sewer channels. The open carriers, or surface channels, may be mere trenches, or, if it be desirable that they should be placed above the ground, constructed of concrete or sheet iron, the sewage flowing in large or small volume, as required, upon the surface of the ground. Sometimes movable troughs are used (Carlisle), but usually the sewage is run through open carriers, and merely the land more or less flooded by the carriers being dammed up at certain parts. Simple contrivances only are required to turn on or turn off the sewage, as needed. The land must, of course, be so levelled and drained that the sewage may flow over different portions of ground, and not into hollows where it would become stagnant, or pass away without undergoing the needful purification.

II. — THE SOIL BEST SUITED FOR IRRIGATION AND FILTRATION.

We may distinguish three cases: —

1. Very porous soils. — A purely sandy soil has had its advocates, on the ground that it becomes richer every year that sewage is applied to it, irrigation thus serving to convert poor into productive land (Way). Bagshot-heath has found favor as sewage land with some, on the ground of its porous, sandy, and sterile character (Lawes: Paxton). In such soils, however, the effluent is generally very impure. A coarse, gravelly soil may be "free," but it most certainly, as a rule, discharges the sewage imperfectly purified, on account of its non-retentive nature.

2. Heavy clay soils, or rather, soils containing a notable proportion of clay, were approved by Liebig, on the ground that clay was the most effective soil for absorbing the valuable constituents of sewage, viz., the ammonia, phosphoric acid and potash. Liebig considered the success of the Craigentinny meadows to be dependent on the clay in the soil. It was his opinion that if the Maplin sands were to be used as irrigation land, 2,000,000 tons of clay would be needed to give them fertility to the depth of one inch.

A soil containing such a proportion of clay as to retard over-much the passage of the sewage through it, acts injuriously; in other words, it is over-retentive — the fact being that, to get the best effect of filtration, the filtration must not be too slow. The effluent is in such cases usually turbid and discolored.

A clay soil (*e. g.*, London clay, the stiff clay beds of the new red sandstone, and the boulder clay overlying the Oxford clay) is impervious to water. Such ground may be utilized by burning and mixing, although the cost of such treatment is considerable.

With clay, therefore, we may have either very slow filtration, the effluent being colored and turbid, or practically no filtration at all. Further, such soils are specially liable to crack and fissure, both by frost and extreme heat; in either case the sewage would run through the soil in an absolutely unpurified condition.

3. Soils intermediate between sand and clay. Perhaps a sandy loam or a loam with a small proportion of clay is that soil best fitted to yield a good effluent where irrigation or filtration through land is practised. Bailey Denton points out that the capacity of soils to absorb water (*e. g.*, a coarse, gravelly soil) is no criterion of its cleansing capability. On the contrary, he says, a loamy soil having sufficient sand to render it free and "to fill it with close interstitial spaces for aëration, will discharge a superior quality of purified water by the under drains." The best results I have myself seen are in the case of soils containing about 86 to 90 per cent of sand with a little clay.

The value of a plant-bearing soil as an absorbent, and possibly as an elaborator of plant food, is worth considering. Way supposed the absorbent action of a soil to be dependent on the chemical action of certain silicates of lime and alumina, which fixed the alkaline bases and allowed the acid constituents (phosphoric acid excepted) to pass in combination with lime. Liebig states that an acre of common clay soil, 4 inches deep, in the neighborhood of Munich, would absorb 2,076 lbs. of ammonia, 1,910 lbs. of potash, 888 lbs. of phosphoric acid, and that, like the stomach which fitted food for the wants of the animal, such a soil fitted sewage for the wants of the plants. Clay, in his experiments, was the best soil for irrigation, sand the worst, turf and peat being intermediate. Voelcker found that clay absorbed potash salts and ammonia freely from its solution, but never completely, the ammonia absorbed being, in great part, but not entirely, capable of removal by washing. Sand absorbed ammonia and potash salts imperfectly. Chalky and marly soils absorbed and rendered insoluble the soluble phosphoric acid more powerfully than either clay or sand.

Voelcker's experiments on the action of various soils on ammonia (*Journal of the Royal Agricultural Society*, xxviii, p. 544), show —

A. — As regards free ammonia: —

1. That all soils absorb ammonia from their solution, but that no soil absorbs it completely.

2. That the stronger the ammonia solution, the larger the absolute quantity of ammonia absorbed, whilst the weaker the ammonia solution, the larger the relative quantity of ammonia absorbed.

3. That if, after the saturation of a soil with a weak solution of ammonia, a strong solution be applied, the soil will absorb more ammonia from the strong solution.

B. — As regards salts of ammonia: —

1. That the soil absorbs the ammonia, the acid of the salt combining with the bases (lime, magnesia, etc.) present in the soil.

2. That absorption is greater with strong solutions of ammonia salts than with weak solutions.

The ammonia absorbed by the soil may be partly removed by washing with water, but the quantity capable of being thus removed is always relatively less than that retained by the soil — in other words, the absorptive power of the soil to absorb ammonia is relatively less than the solvent power of water to redissolve it.

These remarkable results are chiefly dependent on the alumina and hydrated oxide of iron in the soil, and in lesser degree on the presence of lime and other bases.

I wish to remark on the immense advantage in an irrigation-farm of ferruginous earth. I have seen a case where a very good effluent was obtained by the accidental circumstances of a small area (small, that is, in comparison to the entire farm) containing a large quantity of an iron deposit.

The composition of irrigated as compared with non-irrigated soils has been, on many occasions, contentious matter in the courts, and the subject of numerous investigations. The top few inches of an irrigation-farm present, no doubt, a very marked difference from the underlying soil, such difference being dependent partly on the nature of the soil, partly on the method of irrigation, but more particularly upon how far the suspended matters have been removed before the application of the sewage to land, and the extent to which intermittency of action has been practised. If, however, the top inch of the land be carefully scraped off, the difference of the composition of sewaged and non-sewaged ground will probably be found to be small. As regards nitrates, phosphates, and chlorides, the difference is, as a rule, absolutely *nil*. Perhaps there may be a slightly-increased amount of oxidizable organic matter, but even this is by no means invariable, whilst at a depth of eighteen inches, it is a very rare thing to find any marked alteration of composition. It is certain, therefore, that given land of ever so suitable a character as a sewage purifier, its powers are not those, agriculturally, of a storage battery.

Any excess of sewage over that which the plant can utilize at the time is, so far as commercial profit is concerned, wasted, passing off into the subsoil drainage partially or wholly unpurified. As a fact, the land does not store up any quantity of the manurial elements for the use of future crops. The fertility of a given area is not 10 times greater by the application of the sewage of 1,000 persons than it would be by the application of the sewage of 100. In fact, it is no better and no worse. The difference is to be sought in the effluent, not in the land. The Craigentinny meadows are still sandy and poor, despite of all the sewage put upon them. The land, notwithstanding all that has been done for it, still contains less than fifteen parts of organic matter in a thousand.

But how far is absorption dependent on the strength of the manurial fluid applied? Voelcker's investigations on this point have been referred to in detail. His experiments show that when manurial elements in a weak solution like sewage is applied to the soil, it merely oxidizes the nitrogen and strains the fluid, the resulting nitrates flowing away, unless vegetation is growing at the time, when the elements of the sewage may be appropriated. But more than this, his experiments show that a weak sewage may actually remove from a soil upon which there is no vegetation the manurial ingredients already present in it.

That the total soluble nitrogen of sewage may be found in the effluent as nitrates when the sewage is applied to land where there is no vegetation, or where vegetation is inactive, I have many times verified by analysis. (See Table, third report of commissioners appointed to inquire into the best mode of distributing the sewage of towns, 1865, page 46, showing, as the result of sixty-two analyses, that the drainage effluent water contained on an average the same amount of organic and inorganic constituents as the sewage.)

III. — CROPS MOST SUITABLE FOR IRRIGATION.

Nearly all agree that the most profitable application of sewage is to pasture land, osiers, and Italian rye grass. Way says that its application to grass land is the only profitable way of dealing with it — in other words, by feeding it into milk or flesh, and so getting a manageable manure.

Bailey Denton [1] holds a different view, considering that "the less the sewage farmer has to do with stock the better." He is of opinion that the cultivation of grass is unprofitable.

And here I may refer to the greediness with which cattle feed on sewage-irrigated pasture. Mechi states that cattle will follow the hose and feed on the grass wet with sewage. Many who gave evidence before the Parliamentary Committee on the sewage of towns testified to the same effect, the committee reporting that "the evidence proves that cattle of all sorts appear to prefer sewaged grass to all others, and will eat it within a few hours of its being dressed with sewage." And I beg your attention to this fact in passing, for I shall refer to it again when I speak of the dangers incident to eating the meat of animals fed on sewage produce.

I would note, too, that there is evidence to show that a damp and

[1] See Lecture on Maidstone Farmer's Club on "Sewage Irrigation as a Means of Disposal of Town Sewage."

sodden condition of ground, such as is common in a sewage-farm, is peculiarly favorable for the production of the "liver fluke" of sheep (*Diatoma hepaticum*), a disease occasioning great fatality. This danger of irrigation is not undeserving of attention.

Roots. — Some have advocated irrigation for root crops in dry weather (Campbell, of Rugby). The mangold-würzel does well in a sewage-farm.

Miller, of Edinburgh, is against the use of sewage for roots, since he found it made furrows and channels in arable land, and washed the roots of plants bare.

Bailey Denton advocates the growing of roots (mangolds, beets, turnips, carrots, parsnips, potatoes and onions) as better crops for sewage-land than the cultivation of grass.

Cereals. — Some consider sewage suitable for wheat. Mechi advocates its use, although not directly to the land so used (otherwise the wheat grows too luxuriantly and fills to easily), but to a preceding grass, root or clover crop.

The majority of authorities disapprove of its application to arable land, or of its use for cereals, roots, etc. Voelcker says, "It is quite unfit for cereals after the grassy state, because of its forming straw instead of grain, and checking the ripening process." Lawes, Way, Congreve (of Rugby), have expressed themselves to much the same effect. (See also evidence before Select Committee of the Sewage of Towns, 1862).

Its application to corn crops was tried at Watford, Rugby and Alnwick, but abandoned.

Bailey Denton advocates the production of straw upon a sewage-farm as advantageous for feeding stock, although the quantity of grain is small.

Voelcker condemns its use for market produce, "as it clogs the soil and kills the plant."

Bailey Denton specially advocates the cultivation of cabbages on sewage-farms. I remember being told that they had tried growing rhubarb at Aldershot, but that they abandoned it because nobody would eat it a second time, owing to its rank sewage flavor.

At the Brussels International Congress (1876), a collection of vegetables were shown, said to have been grown in fields irrigated by the sewage of Paris. There was a curious silence as to the cost of production.

Liebig, arguing on the quantities of ammonia and phosphoric acid in sewage, in comparison to the quantity of potash, considers sewage less adapted for grass crops than for pasture land. Say 4 tons of good hay (= 12 tons of grass) are grown on an acre of land per annum: this 4 tons abstracts from the land: —

Nitrogen	141.6 lbs.	(= ammonia 172 lbs.)
Phosphoric acid	72 "	
Potash	124 "	

To get 124 lbs. of potash you must have 2,400 tons of sewage. This contains: —

Nitrogen	451.07 lbs.	(= ammonia 547.73 lbs.)
Phosphoric acid	109.6 "	
Potash	124 "	

Now, in accordance with the law that "the effect of all the constituents of a manure is but the effect of that one of them which, in comparison with the wants of the plant, is present in the smallest quantity," it follows that 375.73 lbs. of ammonia, and 37.6 lbs. of phosphoric acid, are not merely wasted, but act injuriously by clogging the soil and killing the plants. On this ground he advocates adding to the sewage potash and phosphoric acid in proportion to the requirements of the crop, thus lessening the sewage required and increasing general fertility. Thus Liebig argues that sewage should always be used in conjunction with richer manures, guano being rich in phosphates and ammonia, but poor in potash; farm-yard manure being rich in potash, but poor in phosphates and ammonia; sewage occupying an intermediate position. The following table will serve to illustrate his views:

	Potash. lbs.	Phosphoric acid. lbs.	Ammonia. lbs.
193 tons of sewage yield	10	8.8	44.1
2,023 lbs. of farm-yard manure	10	9.0	14.9
1,672 lbs. of Peruvian guano	10	200.5	142.3

Voelcker scarcely endorses these views, for he says if the soil itself contain the elements of fertility, sewage has no more value than so much water; but if it be poor and barren, then the application of sewage will produce crops of grass when nothing else of any agricultural value will grow upon it.

IV. — VALUE OF CROPS GROWN ON SEWAGE-IRRIGATED FARMS.

It must be admitted that the size and weight of roots and succulent vegetables grown on a sewage-farm are often considerable. Thus enormous cabbages, turnips, celery, etc., are often shown as sewage-grown. But sewage produce is best described as dropsical, *i. e.*, the percentage of moisture in sewage-grown produce is far higher than in the case of ordinary market produce. (This fact was proved by Lawes in his experiments at Rugby Farm). This being the case, sewage produce is difficult to dry and prone to decompose. It must be consumed fresh, and on the spot, for it will not stand being carried any distance to market. Dr. Voelcker is definite on this point. Irrigated land, it is certain, does not yield so nutritious a product as natural pastures. If you want good produce you must be content with small quantity.

Passing to the solid matter itself, a larger proportion of nitrogen was found in the sewaged than in the unsewaged produce, and the larger the quantity of sewage applied, the larger became the nitrogenous constituents of the vegetation.

PERCENTAOE COMPOSITION OF DRY SUBSTANCES.

	Plot I. No sewage plot.	Plot II. 3,000 tons sewage per acre.	Plot III. 6,000 tons sewage per acre.	Plot IV. 9,000 tons sewage per acre.
Nitrogenous substances	11.16	17.58	18.37	19.66
Fatty matter (ether extract)	3.41	4.13	3.95	4.04
Woody fibre	29.08	28.21	28.32	28.13
Other non-nitrogenous matters	46.73	39.09	38.08	36.91
Mineral matter (ash)	9.62	10.99	11.28	11.26

But here arises the important question, "Are nitrogenous constituents the true measure of the nutritive quality of a produce?" To this Voelcker replies "No." On the contrary, nutritive properties depend on proper maturation, whilst an excessive quantity of nitrogenous produce indicates unripeness, *i. e.*, a deficiency of sugar.

The Birmingham Sewage Inquiry Committee (1871) refer to the difficulty of disposing of the rye grass of the 140 acres of the Corporation Sewage-Farm at Saltley as an argument against the possibility of disposing of the produce of 4,800 acres it was at that time proposed to acquire. The difficulty of finding a market for the produce is the difficulty after you have encountered the preliminary difficulties of getting the produce. Ricks of rye grass and coarse hay are often to be found on the sewage-farm, untempting to the buyer, but serving to swell the balance-sheet of the farm by being entered as so much to the good.

Fattening power of sewage grass. — This question was made the subject of experimental investigation on ten Hereford oxen, two being supplied with unsewaged grass and eight with sewaged grass from land irrigated with 3,000, 6,000 and 9,000 tons of sewage per acre per annum. The reporters state the grass (sewaged or unsewaged) was not well adapted for the fattening of oxen without the addition of other food, such as oil cake. The two fed upon unsewaged grass increased 2½ lbs. per 1,000 lbs. live weight per week, and the eight fed on sewaged grass (of which a greater quantity was consumed per head per day than in the former case) increasing at the rate of 2¾ lbs. Such oxen, however, should yield, if fed on good fattening food, 9 lbs. to 10 lbs. increase per 1,000 lbs. per live weight per week.

Experiments with milch cows. — Experimenting on twelve cows, ten being fed on sewaged grass and two on unsewaged grass, the experiments clearly indicated that considerably less fresh unsewaged grass was required to produce one gallon of milk than fresh sewaged grass, and that a given weight of the animal was more productive when fed on unsewaged than on sewaged grass — but that a given weight of dry substance supplied in sewage grass was more productive than an equal weight supplied in unsewaged grass. The experiments with the rye grass, as regards milk production, are inconclusive.

The chemical analysis of the milk from cows fed on sewaged and unsewaged grass does not indicate any material difference.

But a case before the courts suggests that the milk of cows fed on sewaged grass is more apt to become sour than from cows fed on unsewaged grass. The cases are few, indeed, if there be any, where the keeping milch cows on a farm has really proved profitable.

I have thus far limited myself almost entirely to a consideration of the manurial value of sewage. We must now consider, in connection with manurial value, the second condition of effective sewage treatment, viz., the production of a good effluent.

There now arises the important question, how much sewage can properly (*quâ* agricultural success) and safely (*quâ* sanitary success) be applied to a given area of land.

There are two ways of applying sewage to land: —

1. Surface irrigation, or the distribution of sewage over as many acres as it will wet, having in view a maximum plant growth.
2. Intermittent downward filtration.

I. — SURFACE IRRIGATION.

And here one fact is certain, the agricultural and the sanitary aspects of the question are not in accord. To realize an agricultural success the farmer says, apply at proper times and seasons a large quantity of sewage (and within reason the larger the better) to your land. To realize a sanitary success, a sanitarian says, apply continuously as small a quantity as possible. If sewage be put upon a soil in larger volume than 1,500 tons per acre per annum, even when there is actively growing rye grass upon it, the subsoil water is certain to pass away foul (Way). It was found at the Anerley school farm that the same crop of grass was obtained when 1,500 tons of sewage per acre were applied by hose and jet, as when 8,000 to 9,000 tons were supplied by open carriers, but that in the latter case the effluent water was almost as foul as the sewage (Westwood). At Rugby it was recorded that with 3,000 tons of sewage per acre, a yield of 22 tons of grass was obtained, whilst with 6,000 tons of sewage a yield of 28 tons of grass, and with 9,000 tons of sewage a



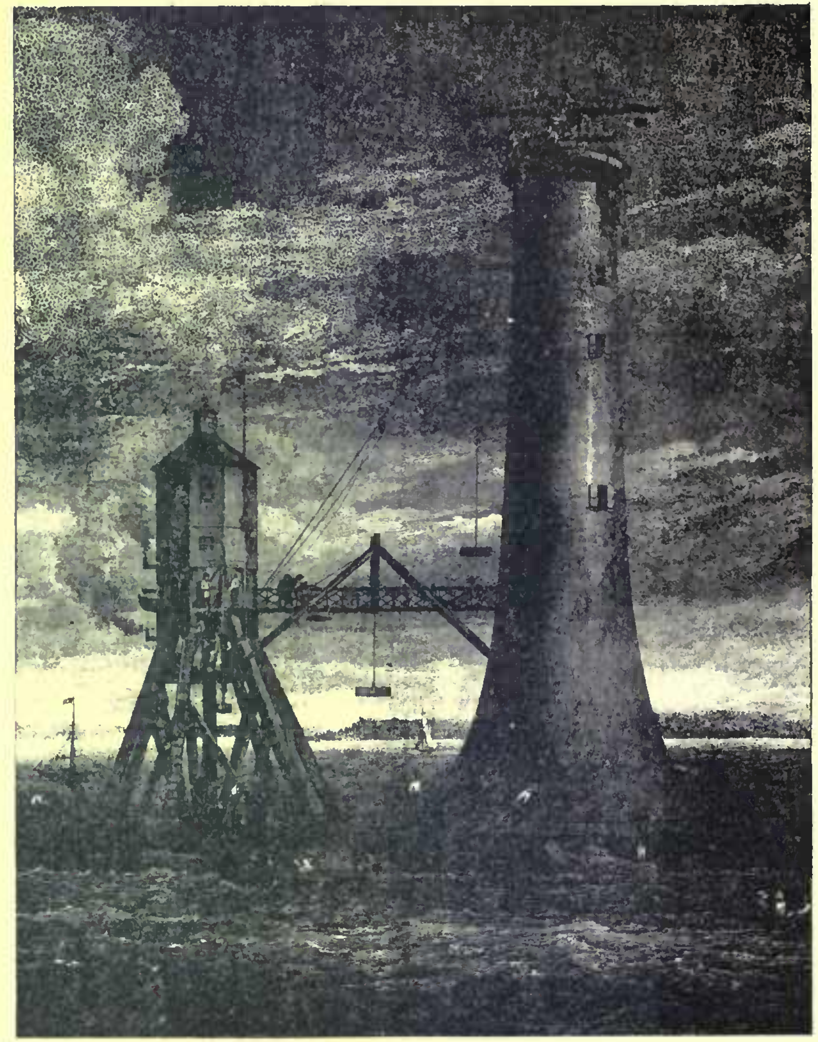
Heliotype Printing Co. Boston.



Drawn by Miss Stevenson. Engraved by [illegible]

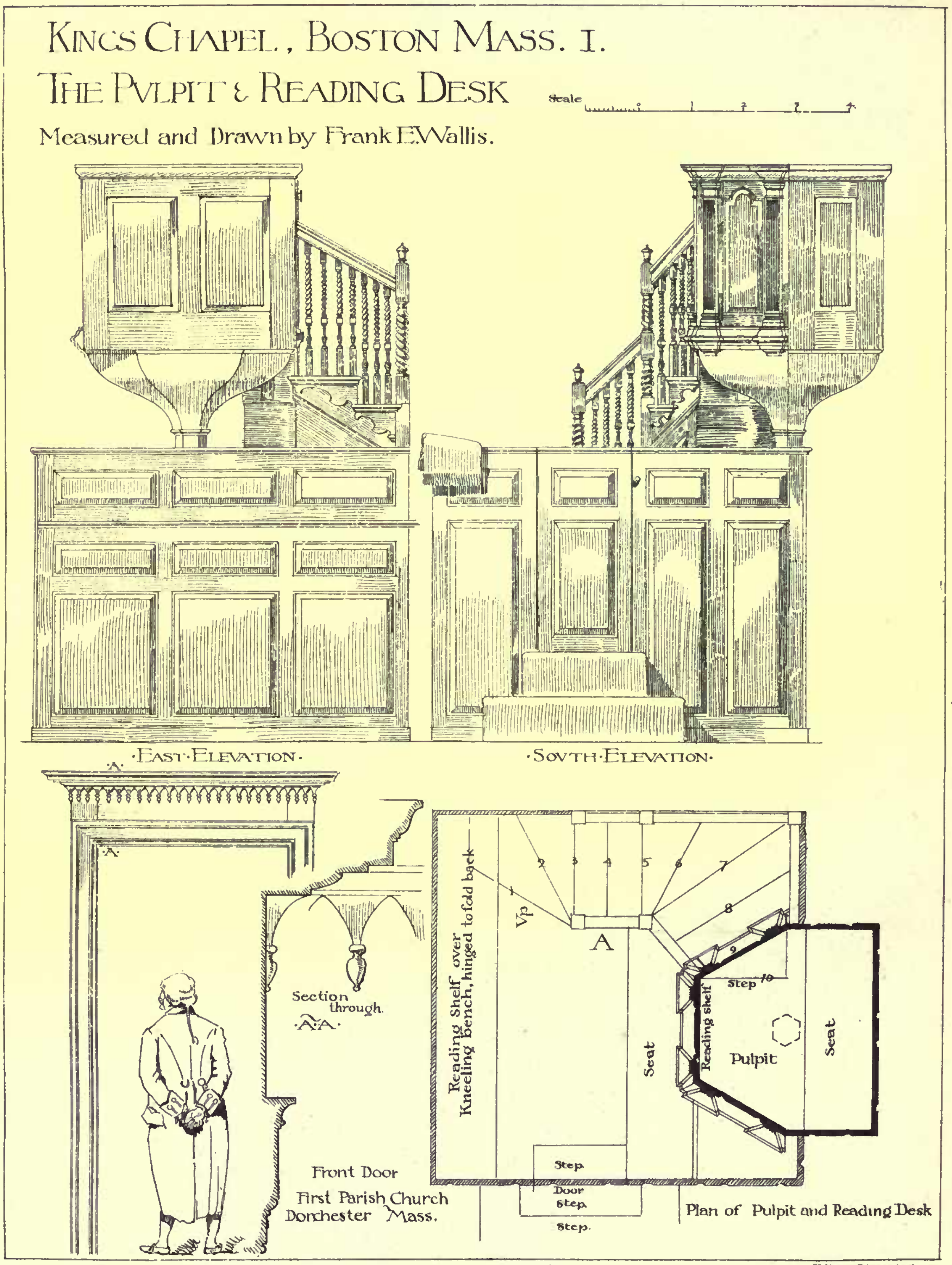
Pharos Loquitur

Far in the bosom of the deep
O'er these wild shelves my watch I keep
A ruddy gem of changeful light
Bound on the dusky brow of Night
The Seaman bids my lustre hail
And scorns to strike his timorous sail



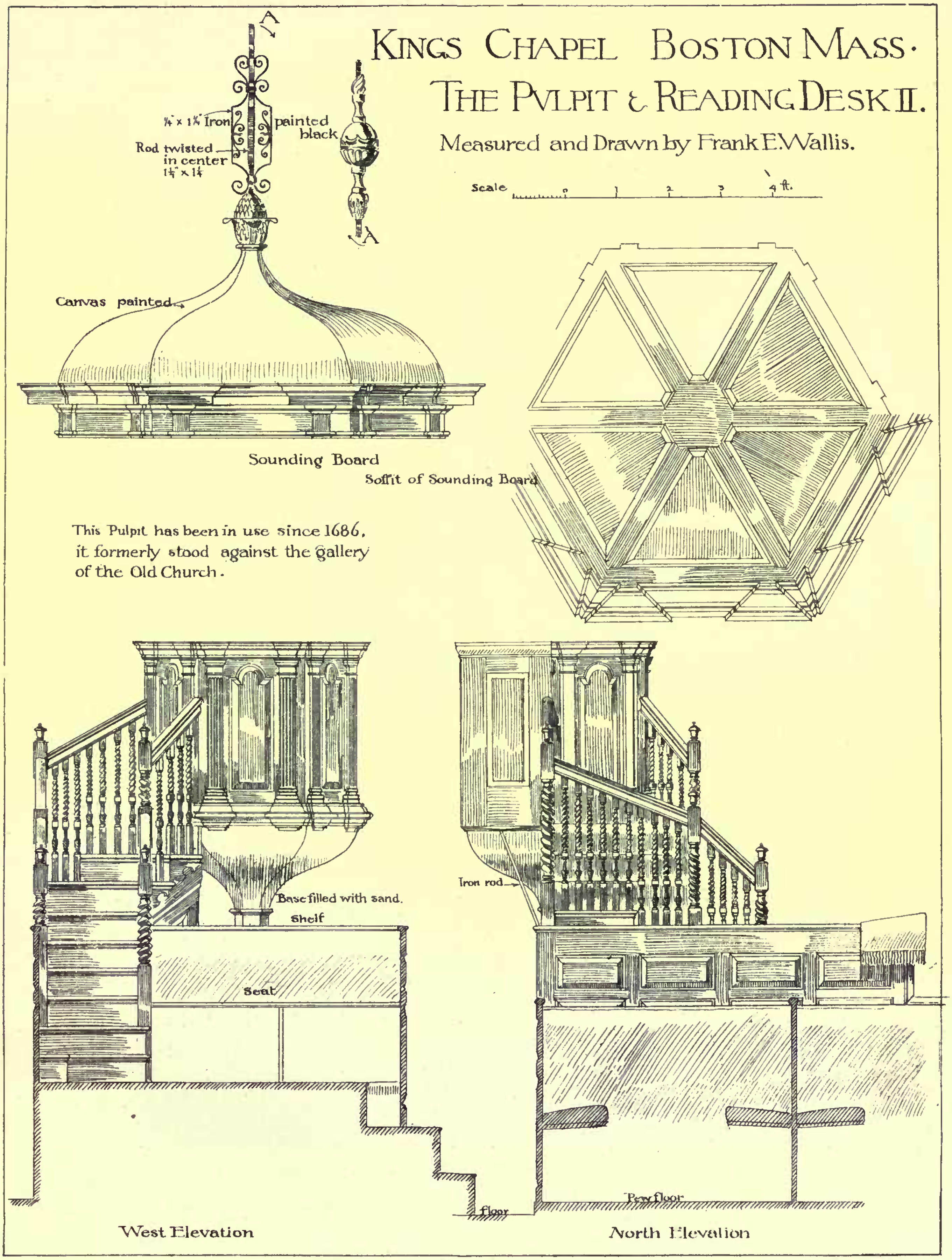
BELL ROCK LIGHT HOUSE

Heliotype Printing Co. Boston.



Heliotype Printing Co. Boston.

Old Colonial Work,



Heliotype Printing Co. Boston.

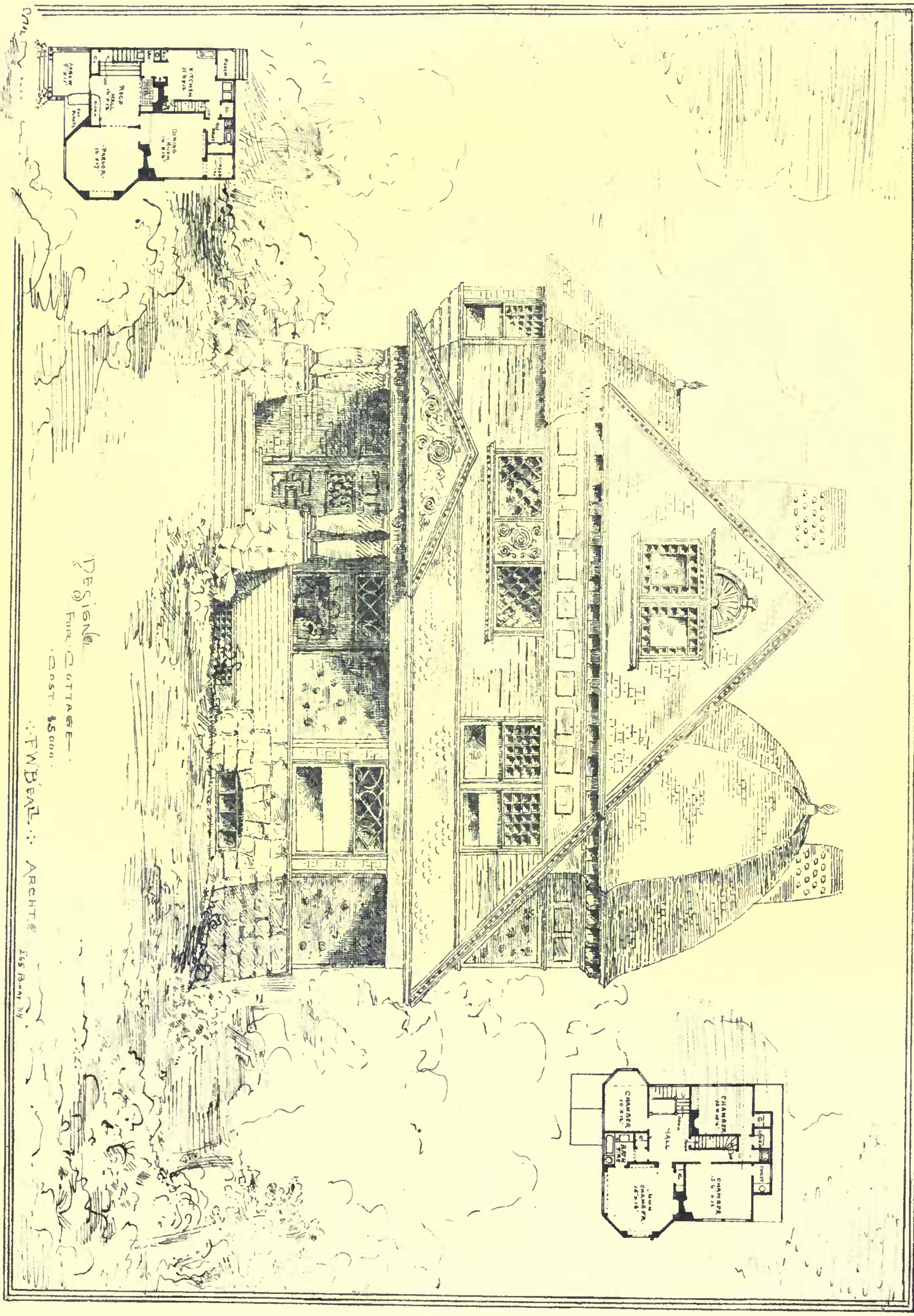
Old Colonial Work,



Drawn by J. M. W. Turner R. A.

Engraved by J. Horsburgh

BELL ROCK LIGHT HOUSE


DESIGN FOR COTTAGE
COST $5000.
F. W. BEAL ARCHT.

yield of 32 tons of grass only was obtained (Lawes). The conclusion is irresistible. There is a limit to the quantity of manurial elements that the soil and plants are capable of appropriating. Exceed this limit and any quantity in excess must pass away in a more or less unoxidized form.

As regards the quantity of sewage that is safe and proper to apply to land, I find authorities differ between 100 tons and 40,000 tons per acre per annum; a difference, in other words, between 2 and 800 persons per acre. Thus an authority "of great weight" expresses an opinion that 300 tons of sewage per acre per annum would accomplish as much as the 10,000 tons he had applied. Another authority considered the Rugby farm inferior to the Edinburgh meadows, because in the former from 3 to 9,000 tons of sewage per acre only was applied, whereas, in the latter, 10 to 12,000, and even 30 to 40,000 tons have been used. Mr. George Sheppard and Mr. Mechi considered 100 tons of sewage per acre per annum sufficient (or the manure of two persons). The latter lived to find his estimate erroneous, increasing his quantities at first to 500, and finally to 3,000 tons per acre for green crops. Miles, of Bristol, reported that two persons per acre gave good results, whilst Mr. Thomas Ellis considered (and in this Mr. Brady, the chairman of the Select Committee on Sewage, agreed), 600 tons of sewage (or the produce of a dozen people) advisable.

Mr. W. Hope and Mr. Westwood, of the school farm at Anerley, considered an acre of land was required for every twenty or thirty people (1,000 to 1,500 tons of sewage per annum), for, said Mr. Westwood, "if more than this be used, it runs away into the drains and fouls the stream." This he found to be the case when 8,000 or 9,000 tons per acre was applied to land cultivated with rye grass. Liebig considered 2,430 tons of sewage sufficient for meadow land to yield 12 tons of grass (4 tons of hay) per acre. He adds, a soil saturated with manure not only fails to increase the crop, but, in the case of roots, is positively hurtful. The Earl of Essex (Chairman of the Commission, to inquire into the best method of utilizing sewage), after many trials at Waterford, decided that 5,000 to 6,000 tons a year was desirable to each acre for Italian rye grass, but that 600 tons to each acre was sufficient in the case of meadow land. Voelcker fixes 2,000 to 4,000 tons per acre for better kinds of land, and 8,000 to 10,000 tons to sandy soils, stating "that he has nowhere seen such small quantities as 300 or 400 tons per acre produce any remunerative effect." Way likewise fixes 100 persons to the acre, provided the land be grass land, estimating that 30,000 acres of land would be required if the sewage of 3,000,000 people had to be dealt with.

Sir R. Rawlinson states the case thus:

"The means which have been found in practice to answer are as understated, namely, for flood irrigation about one statue acre to 100 of population of a fully water-closeted town, but there cannot be any hard-and-fast rule." (Suggestions, 1878.)

In nineteen irrigated towns, according to Professor Robinson ("*Sewage Disposal*," p. 79), there is an average of 137 persons to each acre (= to 5,128 gallons per acre per day, or 38 gallons of sewage per head of the population per day). Mr. McKie, of Carlisle, records the average of 53 towns as 98 persons to each acre (= to 3,826 gallons of sewage per acre per day).

Lawes and Rawlinson also agree that an acre of land is required for every 100 people (or 5,000 tons of sewage per year), a view agreed to in the main by Bailey Denton, who fixes 100 to 150 people, according to the porosity of the soil, lighter soil taking the sewage more freely than heavy. In Bailey Denton's opinion, however, extra land is needed for giving rest, and for permitting alternate cropping.

The difficulties, it will be seen, are tremendous. For commercial profit the sewage must not be less than 5,000 tons per acre — for sanitary efficiency (*i. e.*, to prevent nuisance), the quantity must not exceed 1,500 — *i. e.*, a minimum of 100 is necessary to pay — whilst 30 is the maximum to escape prosecution.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE ROTCH TRAVELLING SCHOLARSHIP DRAWINGS. — PLATES XXX, XXXII, XXXIII.

[Issued only with the Imperial edition.]

HOUSE TO COST $5,000, DESIGNED BY MR. F. W. BEALL, NEW YORK, N. Y.

THE arrangement will be found compact, with opportunity for a very neat and artistic interior. First, a "reception-hall," with large fireplace under a 9′ arch, the floor of the recess tiled and a seat built in. A broad effect of staircase, with three windows following the rise, looking from hall to parlor, and from this to dining-room, which also connects with hall. You look from dining-room into small conservatory, which can be seen from main entrance of house. Butler's pantry connects dining-room indirectly with kitchen, with back staircase to second floor and cellar. There is also an indirect passage from kitchen to hall with lavatory under front stairs. Second floor: four bedrooms, principal chamber connecting with spacious bath-room containing good closet, also entering hall. All rooms, one excepted, have fireplace and ample closet or toilet. Attic to have billiard-room, servants' room and store-closets. Dumb-waiter running from cellar to second floor. Base of octagon to be of brown rock-face stone, laid up in red cement in irregular sizes; foundation to rear and sides to be of good quality brick. The two chimneys, where exposed, to be of good face-brick. House to be painted in subdued color; sienna, yellow ochre, chocolate, dark green, several tints of terra-cotta and indian-red trimmings. Hall to be neatly finished in oak (old); other rooms to be either white or yellow pine, painted in subdued colors, "dead finish," with frieze and wainscot of stipple work, with stencil pattern; to have neat picture-moulding and stair-rail. Each room to have neat wood mantel, tile trimmings. House to have furnace, running-water, gas, speaking-tubes, etc.

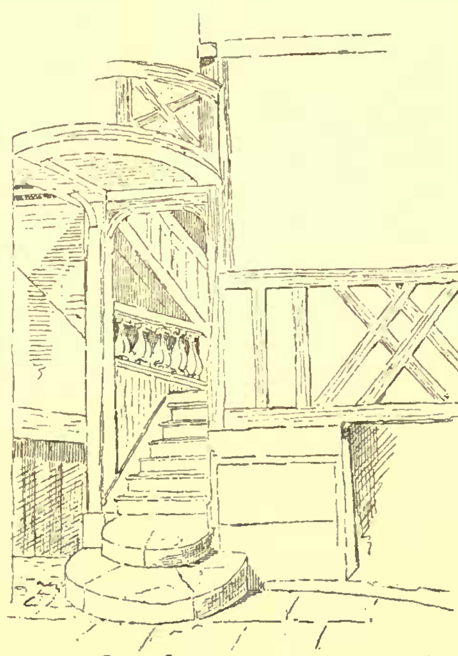
DETAILS OF KING'S CHAPEL, BOSTON, MASS. MEASURED AND DRAWN BY MR. F. E. WALLIS, BOSTON, MASS.

BELL ROCK LIGHT-HOUSE.

FOR description see article on "Ancient and Modern Light-houses" elsewhere in this issue.

STORE ON STATE STREET, CHICAGO, ILL., FOR B. HAGAMAN, ESQ. MESSRS. ADDISON & FIEDLER, ARCHITECTS, CHICAGO, ILL.

THE VENTILATION OF FACTORIES AND WORKSHOPS.[1]



OLD STAIRCASE IN COURT YARD ROUEN. FRANCE. AFTER SKETCH BY H.G.KING

THE efficient ventilation of factories and workshops is a very important branch of practical sanitation, and as I cannot find that it has been dealt with previously, I venture to put before you some considerations and suggestions which are the result of my experience in this particular line of sanitary work. As the chief trades carried on in factories are the textile trades, it may be interesting to know that, according to the census return of 1881, the number of persons engaged in those trades in England and Wales was over a million; of whom 530,000 were engaged in cotton trade, and 233,000 in the woollen and worsted manufacture; the remainder being engaged in the manufactory of hosiery, silk, lace, linen, carpets, hemp etc. In the cotton manufacture the proportion of the sexes employed was 164 females to every 100 males; in the woollen-cloth manufacture there were 102 females to 100 males; and in the worsted and stuff manufacture 180 females to 100 males; in the silk and ribbon manufacture the proportion of females was still greater, as there were 224 to 100 males. As there is no doubt that a considerable proportion of factory operatives are young persons, the importance of efficient ventilation is further emphasized, and is generally admitted by every one in theory. But, judging by the state of many factories and workshops, its importance is very slight, in practice; and the following extract from the last report of the Chief Inspector of Factories and Workshops is interesting in this connection. He says: "The injury inflicted by an unfenced piece of mechanism cannot be hidden, and inquiry as to its cause leads to a recommendation which prevent accidents in future. But the evils which follow constant employment in overcrowded and ill-ventilated workrooms, are insidious in their inception, rarely complained of openly by the sufferers, and do not in their effects appeal so readily to the sympathy of employers, as do the injuries to the person caused by machinery. It becomes thus a more difficult matter for us to deal with overcrowding and want of ventilation."

The particularly unhealthy conditions under which the textile trades are carried on, are commented upon as follows, in the supplement to the last annual report of the Registrar-general. He says: "Among the textile industries there are two in which the death-rates

[1] A paper by William Tattersall, read September 23, 1886, at the Congress of the Sanitary Institute, held at York.

are high, and unfortunately these are the two in which by far the largest number of persons are engaged — viz., the cotton industry of Lancashire, and the woollen and worsted industries of the West Riding. The comparative-mortality figures in these industries are 1,088 and 1,032 respectively. It can scarcely be doubted that the main cause of the differences is to be found in the conditions under which the industries are severally carried on, and especially in the differences that they present in regard to the dustiness and the temperature of their respective working-places. In the cotton factories the temperature of the weaving-sheds is described in a recent (October, 1883) report, by Dr. Bridges, to the home secretary, as 'tropical and relaxing;' and dust, composed partly of filamentous particles of cotton and partly of mineral substances used for sizing, is stated to be a notable feature in most of the sheds." It will be found, also, on examining the tables, that the death-rates from diseases of the respiratory organs are very high in the Lancashire and West Riding towns, where the textile trades are mainly carried on. As the following extract from the supplement previously mentioned also indicates; writing of the effect of dust on the respiratory organs, he remarks: "More injurious than either coal-dust, wood-dust, or the dust of flour, appear to be the filaments and fluff and other dusts that are given off in textile factories; the mortality both from phthisis and from diseases of the respiratory organs being higher among workers in cotton and workers in wool than among persons exposed to either of the previously-mentioned kinds of dust. The workers in cotton factories fare worse than the workers in wool, the comparative mortality from the diseases in question being 543 for the former and 462 for the latter. It must be remembered, however, that the air in the weaving-sheds of cotton factories contains not only flocculent matter, but also a large amount of dust from mineral substances of various kinds used in sizing, and that the inhalation of mineral substances, judging from industries presently to be considered, is much more injurious than the inhalation of textile filaments. The deleterious effects of dust upon the air-passages is increased both in the cotton and in the wool factories, and especially in the former, by the high temperature in which the work is carried on, and it is impossible to say how much of the lung mortality is due to the latter cause, and how much to the dust.

So much then for the considerations as to the need of ventilation in factories, and I take it that if they had been more efficiently ventilated than appears to have been the case when the foregoing observations were made, and which, by my own observations, is the case now in most factories, the presence of polluting matters would not have been so evident, as they would have been got rid of as fast as produced, and so the evils resulting from their presence would have been much less.

I pass on now to the consideration of the means by which these evils can be lessened by an efficient system of ventilation, and in doing so I propose to consider the main sources of impurities separately, and in each case the production, amount, effect and removal of such pollution. The main sources of impurity in factories, I have found to be as follows: and I say nothing further of the impurity arising from or given off by the workpeople themselves, as that is seldom or never the only or main source, and is merged into the greater both in effect and removal. The principal impurities are dust, fumes, excess of moisture and heat. Objection may be taken to moisture and heat being considered as impurities, but in excess their effects are probably as ill as those of the actual impurities, and therefore they need removal.

In many cases several of these impurities are present together, aggravate the nuisance and often make its removal more difficult. Dust I have found to be the greatest impurity, and to be present, more or less, in almost all the processes through which textile fabrics pass in manufacture, and often where the stuff is made into clothing.

The rooms where the carding, combing, winding, spinning, etc., of cotton, woollen, worsted and other textiles is carried on, all have their air rendered impure by the dust and particles of fibre given off from the material in course of manufacture, and, in addition, the sheds in which cotton goods are woven, and especially with certain classes of goods, the solid particles of the size with which the yarn has been treated become loose, and in addition to particles of cotton, float about in the air of the shed in considerable quantities; and to prevent this result, and because more work can be got off in a certain time with a moist atmosphere, an apparatus known as a "humidifier" is used, by means of which saturated air at a high temperature is forced into the shed, keeping the air inside hot and moist, and to prevent radiation of heat and condensation of the moisture, all apertures that might admit fresh, cool air, are carefully stopped up, including both inlets and outlets for ordinary ventilation, if any have been provided, which in many cases they have not; some employers simply blow steam into the sheds during meal-times, and trust to that for keeping the place moist enough for their purpose during the rest of the day. An artificial moisture is most needed during frost; the effect of passing from the warm, moist air of the weaving-shed to the cold, frosty air outside, must be very injurious, as may be imagined.

A report on this subject was, I believe, made some years ago by Factory Inspector Osborn, in which he came to the conclusion, that by using proper ingredients in the preparation of size, there would be no need to introduce moisture into the sheds, and as the principal object of heavy sizing is, I presume, to give a fictitious weight and value to the cloth, not much sympathy would, I think, be extended to manufacturers if they were forced to discontinue such an unhealthy system.

In the weaving-sheds of other textile trades, as woollen, silk, worsted and flax, the impurities consist of dust and fine, loose particles of whatever material may be worked there; with, in winter, during a considerable part of the day, the impurities from a great number of gas-lights, and in summer, great heat from the sun shining upon the glass roofs, and in some cases always, and especially in hot weather, the foul smell from closets and urinals adjoining the sheds, and not properly ventilated or constructed, or not regularly emptied.

Carding-rooms, at particular times, when what is called grinding the cards is taking place, and the preparing-rooms for silk are extremely dusty. The breaking-up rooms also for other materials, such as waste, shoddy, and rags for paper makers, and esparto grass cleaning, and the rooms where these materials and wool are sorted into different grades or qualities, are often so full of dust that the workpeople, who are mostly women and girls, have to wear a bandage over the mouth and nostrils to enable them to work at all. In many of the workrooms enumerated above, there is a great excess of heat, and in some very foul smell arising from the material; the worst in this respect being probably silk-waste preparing-rooms, in some of which the stench is frightful to a stranger, though it is said that the workpeople become used to and do not perceive it after a while. In many workrooms also, other than textile, there is a large amount of floating dust to contend with, as in all dry-grinding processes where metal is ground on revolving discs, examples of which are: the glazing of metal faces in machine-shops on emery discs, and the pointing of pins for textile machinery, in which processes large quantities of minute particles of metal and stone are set free and float about in the air.

Excessive Heat.— There are many workrooms in which this is experienced. The machine-rooms in calico-printing works, some of which in summer get as high as 130° Fahrenheit. The machine-rooms also in paper mills, and the rooms in which fine yarns, both cotton, woollen and silk, are gassed, or run through flames produced from a mixture of coal-gas and air to finish them smooth. These rooms are the foulest that, in a considerable experience, I have come across, and this is not to be wondered at when we know that some thousands of gas-jets are burning, and the whole of the fine particles that have been singed off the thread, are floating about in the room, and produce an intolerably irritating effect on the throat, nose, and eyes of strangers; and I have often seen the women and girls forced to go outside and stay out a considerable time, to recover from the effects of working in such an atmosphere. The finishing, singeing, dyeing and pressing rooms for textiles have usually a very high temperature. The rooms in which wool is washed, and cotton and woollen yarns are sized and dried, and the drying-rooms for wool, yarn, cloth, etc., are among the worst, and especially as the excessive heat is accompanied with excess of moisture. I have known many rooms of this kind to have temperatures from 150° to 200° with the air so full of moisture that a fall of 20° would produce saturation.

The combing and spinning rooms are kept above normal temperature and artificially moistened, but it is said that it is necessary to produce good work.

In other than textile factories the ironing-rooms of steam-laundries, and the making-up and pressing rooms of wholesale clothing factories, in which much gas is burnt to heat the irons, are examples of workrooms in which the temperature is excessive, and the air foul.

Steam or excess of moisture, as an impurity, has already been mentioned several times, besides which it is found in excess mostly in dye-houses, where it is often produced in such immense volumes, and so continuously as to be quite beyond the power of any appliance to remove at a reasonable expense. In cold and foggy weather the moisture becomes most visible, as the point of saturation is sooner reached, and dye-houses become filled with thick fog for days together, so that nothing can be distinguished at a few feet distant. As dye-houses are generally of open and lofty construction, and there is no excessive heat, the health of the workmen does not appear to suffer much from their constant work among steam, and one hale old fellow of seventy-five, to whom I spoke, seemed to think it beneficial.

The construction of factories or rooms will govern the application of any system of ventilation to them. The ordinary method of ventilating weaving and other sheds has, I think, usually been inefficient by reason of the contrivances for exhausting the foul air being inadequate at their best, and uncertain in action when most needed, and also because the inlets for fresh air were not under control as to the quantity, temperature or direction of the air admitted.

The exhaust has usually been, by means of automatic ventilators of various kinds plentifully sprinkled about in the roof, and without, in many cases, any particular provision for inlets, or simply holes in the walls which allowed the air to enter in gusts, and insured their being speedily closed or stopped up with rags or anything else convenient. The lobster-back cowl, and other wind-driven ventilators, are liable to get stuck and act as inlets, and the same remark applies to other forms of ventilators which are driven by the wind, besides which in hot weather, when most needed, there would very likely be no wind to cause them to act. This last remark applies also to induced-current ventilators, besides which none of those mentioned produce, at the best of times, sufficient movement of air to carry away the particles of floating dust, so that, for this purpose, an

appliance is needed which will move air in large volumes constantly, and be under control, as to the quantity moved; this is found in a type of exhaust-fan, dealing with large volumes of air at low pressure, and requiring small power to drive, and which, placed near the centre of a shed, will exhaust air in proportion to the speed at which it is driven, and may be regulated to suit the temperature and other requirements, or amount of impurities existing. We thus get a current of fresh air traversing the shed from all sides to the centre, and there being *constantly* discharged, irrespective of wind or weather. In some large sheds, several may be necessary, and in one very large one I put four fans, having an aggregate displacement of 120,000 cubic feet of air per minute, or 7,200,000 cubic feet per hour, which changed the contents about eight times per hour.

The best results have been achieved by placing one or more exhaust ventilators near centre of shed roof, and arranging the inlets at regular distances around the walls. The amount of air to be passed through will depend on the temperature and rate of pollution inside, and the inlets may, if needed, be carried down from roof, and the entering air warmed, cooled, or moistened at pleasure; there are plenty of appliances to be had by which air can be admitted without draught. A series of rooms, one above the other, may, if not too large, be dealt with by one exhaust ventilator, placed at the top of a vertical shaft, extending through the several stories and with outlets from each room; the inlets for fresh air to each room being so arranged that the air may, in its course from inlet to outlet, traverse the room, and especially that part in which the greatest source of pollution exists.

It is obvious that a series of small rooms on the same floor-level may be dealt with in a similar way, by a horizontal air-duct with openings to each room, and inlets as suggested above. In storied rooms too large to be dealt with in this manner, each room may be treated separately, and many large workrooms are so treated, by having one or more exhaust-fans placed on one side of the room, and fixed either to discharge through windows or openings specially made. The inlets in this case would be arranged on the opposite side of room to fan, and possibly at the ends, if required, so as to cause the current of air to traverse the sources of pollution, whether dust, heat, fumes, or steam. Generally, the requisite effect in removal of polluting matters is obtained by running the fans entirely free from any kind of tubes or feed on room side; and, where possible, this is best, as less power is needed to drive them, and more air is moved when the area of feed is unrestricted. There are, however, some cases in which it is necessary, and many in which it is advisable, to carry away polluting matters immediately they are set free, so as to prevent their distribution in the atmosphere. In these cases it becomes necessary to construct tubes with openings near the source of pollution, and connected at the other, or exit end, with a fan, which, when working, produces a powerful exhaust, and carries away the polluting matter as fast as it is produced. This arrangement may be, and is, applied with perfect success to remove dust, heat, steam, and fumes of various kinds. The tubes may be carried overhead, underneath, or level with the sources of pollution, and the impurities carried away may be dealt with in a chamber, so as to retain them and allow the air to escape pure. A good type of this arrangement has been largely carried out for the prevention of what is called "wool-sorters' disease." The men who sort the wool work at continuous tables, which usually are fixed along the sides of large rooms, close to the walls, and at which each sorter works opposite a window, on account of the light. In sorting the wool, the sorter takes a portion from the heap placed on the table near him, and shakes it to loosen and open it out, so that he may judge of the quality, color, etc.; and it is at this point that the greatest danger of infection occurs, as the shaking sets free the dust, short fibres, and other light matters, amongst which may be the bacillus, or germ of infection. To prevent, or, at any rate, lessen the risk of infection, there is made, opposite each sorter, an opening in the table, to which is fixed a short, downcast tube, which is connected to a larger horizontal tube beneath the table, at the extremity of which is working a fan that produces a powerful exhaust current in the system of tubes, and carries away the dust produced by the sorters shaking the wool, which they do over the open ends of the small tubes.

In opening the bales of wool, also, a similar arrangement is used, but on a much larger scale, as the quantity to be dealt with is very much greater. In both cases there are wire gratings above the tables to keep the wool out of the tubes and allow the solid, but not floating matters to fall on the table for collection. This dust is most successfully dealt with by being blown into a settling chamber, in which a series of steam-jets meet and damp it, so that it is deposited, and can be collected and burnt periodically.

I may mention, amongst other applications of this system, the removal of dust from silk-dressing machinery, in which the main air-ducts are carried overhead, with small vertical dependent tubes, terminating in hoods, which cover the area of dust-production, confining it and facilitating its removal.

The fine dust produced by dry-grinding processes, in which metal is ground against rapidly-revolving discs of emery or stone, is also removed by a similar arrangement, in which the main tubes are about level with the grindstones, and have openings opposite each stone in such positions as to catch the dust as it is driven off and carry it away at once.

It will occur to any one acquainted with work in factories that this system of extraction along tubes may be applied with great advantage in many cases not specified in this paper. This is so; but, to avoid error, I have mentioned only such as I have designed and seen carried out, and are now in operation; and not all of these, by any means.

In the construction of the air-ducts, the following points need attention; and the suggestions I offer are the results of, and have been verified by experience.

The best material for tubes is galvanized sheet-iron of a gauge proportionate to the diameter of the tube; it is light and strong, and is easily made into tubes of a circular section, which are smooth inside, and reduce friction to a minimum.

Wood is the other material available for tubes, and the objections to its use are, that it cannot be formed into a circular section, is liable to warp, twist, and crack, and cause greater friction of the air, and consequent loss of power. Its advantage is that it is cheaper (about one-third) than galvanized-iron for tubes of same size.

In forming ducts inside walls or underground, the best materials are: for large air-ducts, glazed-bricks set in cement; or, for smaller ducts, glazed and socketed earthenware-pipes jointed in cement. Bends, and especially right-angled ones, should be avoided as much as possible; and, where unavoidable, should be curved to a large radius, or the tubes enlarged to reduce friction; inspection-holes should be provided near bends. Branch tubes should be connected to main tubes by being curved in the direction in which the current of air is travelling, and I have got the best results by bringing small tubes, such as those connected to the wool-sorters' tables, into the main tube at an angle of 45°, and enlarging them at the junction.

The openings near the fan should not be made too large, so that those farther away may get their due proportion of draught. If this is not done the fan draws its supply of air from the nearest openings, and the farther ones are of no use.

No particular rules can be laid down to work to in proportioning the sizes of openings according to their distance from the fan, as much depends on the sizes, materials, section, number of bends, and length of main tube; but a safe plan is to have each opening provided with a slide, so that they can be adjusted to give equal draughts, and then fixed to prevent tampering with by work-people, who very often imagine, if they see an open tube, that they feel a draught, and would rather, in many cases, stand the chance of infection than have the temperature of the room lowered by a good system of ventilation without heating. In one case I know the wool-sorters employed by a large firm petitioned that the system of ventilation described above might not be applied to their tables until the rooms had been heated by steam-pipes, which it took several months to do, and during which time they were working in a constant atmosphere of fine dust. In many other cases I have known work-people stuff up every opening, and even paste paper over every crack or crevice that might admit fresh air. This sensitiveness is no doubt largely due to the quiet, still nature of their work, which requires very little moving about or exercise, and causes them to feel the smallest movement of the air. At the same time there are many work-people who are very careless of the way in which they expose themselves or others to insanitary conditions, and will take their food without washing their hands, or removing their working smocks, and even take their meals seated on their work benches or table, and amongst the unhealthy matters they may have been manipulating, and this in spite of the fact that special facilities have been afforded them in the shape of washing and dining rooms. Though many of the operatives are no doubt very careless and ignorant as regards sanitation, still there are some who appreciate its benefits, and credit is due to those amongst the wool-sorters who agitated for compulsory by-laws to compel the best-known means to be taken for the prevention of the mysterious and fatal disease to which they are subject, which agitation resulted in a series of regulations being drawn up, and agreed to by the local authority, employers and operatives, which, though not compulsory, are generally carried out, and must contribute very greatly to the general health and comfort of the work-people

Employers are not always willing to take the necessary steps, and spend the necessary money to insure even moderately healthy conditions in their workrooms, where there is not a direct and perceptible result in better work turned out or more of it. This disinclination is to be traced in many cases to the fact that they have already spent considerable money in that direction without getting adequate results, and so become doubtful of any good result following further expenditure, though no doubt the feeling of some employers on the matter is similar to that of one who asked the cost of ventilating a room, in which the operatives complained of being nearly roasted, and on being told the cost, which was evidently much larger than he imagined it would be, he simply remarked, "Let 'em roast, then."

In conclusion, looking at the important bearing that the efficient ventilation of factories and workshops, not only in the cases mentioned, but also in very many others, has upon the public health, it seems to me that there should be some authority with power to compel the best known (or at any rate a satisfactory) means of ventilation to be carried out in what may be termed unhealthy trades. What that authority should be, or the circumstances under which it should act, I do not pretend to suggest, but think that the Council of the Sanitary Institute might profitably consider the matter, and prepare a recommendation on the subject.

The exhaust-ventilator mentioned in this paper is that known as the Blackman air-propeller.

THE CHATEAU DE CHANTILLY AND ITS TREASURES.



Gravestone of Thomas Clark, Mate of the "Mayflower," Plymouth, Mass.

IT is somewhat surprising that although nearly a month has passed since the announcement of the Duc d'Aumale's testamentary disposition was made to the French public, so little has been said, so scant praise has been accorded in every mention published of this magnificent donation, whose real importance does not seem to be at all appreciated. The Orleanist newspapers called attention to the munificence of the giver, but in terms where a substratum of regret that it should thus go out of the family was apparent; the particular organ of the Comte de Paris scarcely noticed it at all, whence the conclusion that the Pretender was not pleased by this dereliction from the traditions of a family whose motto has always been "get all you can, and keep what you've gotten," while cynical Henri Rochefort sneeringly remarked that gratitude is inopportune, as in the first place, the motives of the gift were visible, to wit: a hope that the session of Chantilly to France might procure a rescission of the ukase of banishment; and in the second place, that as the entrance into possession of the legacy by the French Academy would be subsequent to the Duke's death, it would be better to wait and see if in the meanwhile he might not change his mind.

Republics are proverbially ungrateful, but in this case it has not been a question of republics; on all sides there has been a concert of that faint praise which, we all know, is as damning to man as the severest censure. Now, I am not an admirer of the Duc d'Aumale, whose military reputation is usurped, and whose literary reputation and seat among the Immortals of the Academy are due solely to the accident of his birth; but it is simple justice to the individual to say that the act by which Chantilly has been turned over to the said Immortals is irrevocable and cannot be rescinded; that it was not made with the view of having his banishment annulled; having been made and registered two years before that eventuality was foreseen. Whether it was made public in order to get up a feeling of sympathy in his favor is another question. But with this question I have naught to do; my intention is to tell what was given, not to speculate upon the motives of the donator, and when I reflect upon the difficulties of finding out the information which I now retail I can understand why it is that reporters have been so reticent as to merit the accusation of indifference. The people who have been left in charge of the château are singularly discreet, and there is scarcely anything left beneath its roof which can help the researches of an inquisitive visitor. The shelves of the library are empty, bare are the panels of the picture-gallery, and in the vestibule stand great packing-boxes stuffed with drawings and engravings, whose former places upon the walls are marked now with mere slips of papers. The Prince takes everything of value away with him, and as he intends to divide his future existence into two parts, so he divides into two parts his treasures; his books and his pictures go to London, his drawings and engravings to Brussels, which, if I were inclined to philosophizing, might furnish me with a text about the vanity of human affairs, and the painful strangeness of this contrast, when the owner is obliged to spoil his dwelling of collections precisely at the moment when he takes measures for their definite installation there after his demise.

The domain of Chantilly, ground and buildings inclusive, is estimated at 22,000,000 frs. to 25,000,000 frs., and as connoisseurs value the library and art treasures at 10,000,000 frs., as a minimum, 35,000,000 frs. may be taken as an approximative total, although, as will be seen as I go into details, these two estimates are much inferior to the reality, as among the collections are many objects which are inestimable. For instance, what money would be considered adequate compensation for the loss of the altar-piece by Jean Gorigon; of Mignard's portrait of Molière, the only authentic effigy of France's greatest writer, of the "Hours of Duke Jean de Berry," which is reckoned to be the most magnificent manuscript in the world, or of the correspondence of Richelieu? The annual revenue of the domain is about 600,000 frs.; but here again there is nothing definite, as the Institute will certainly turn to account much that the Duc d'Aumale has left unproductive, as, for instance, the pavilion of Enghien, a vast building with thirty-six windows of façade constructed by the last Prince of Conde for the accommodation of his guests and his suite; the famous stables as spacious as the castle itself; the château of St. Firmin, a delicious summer residence, standing in a park of nearly thirty acres, and the preserves plentifully stocked with game, which situated at only forty minutes' distance from the metropolis, will command any price among Parisian sportsmen. At present, Chantilly is burdened with charges of two kinds, an annuity of 200,000 frs. payable to the Crédit Foncier for the reimbursement of a loan of 4,000,000 frs., contracted by the Duke in 1874 for the reconstruction of the château. These payments will only end in the beginning of the next century; but a special clause in the act of donation permits the Institute to sell off some of the domain if it be deemed advisable to discharge the debt immediately. The other charges are a series of perpetual pensions, of which the total amounts to 30,000 frs., per annum. Admitting, however, that the Immortals do not take steps to increase the revenue, even when all yearly charges and expenses be paid, there will remain a clear sum of 300,000 frs. to be divided every twelve-month among the five sections of the Academy. The question has been asked, by whom will be discharged the transfer duty, which may be estimated at 350,000 frs.? By a special privilege granted to the Institute when it was reorganized it can receive all legacies and donations free of all duties and taxes. On that point, then, there is no difficulty to be encountered.

The domain of Chantilly was constituted seven hundred years ago. It belonged originally to the Counts Bouteillier de Senlis, then to the house of d'Orgemont, and by marriage, later, to the Montmorency, whose most illustrious representative the Constable Anne, of whom it was the favorite residence, has left there admirable traces of his taste for art. Anne lived at the most brilliant epoch of the Renaissance, and the greatest artists of the time, Jean Bullant, Jean Goujon, Bernard Palissey, and le Limousin, were at his service, which will explain why its present owner desired that the statue of the great Constable should have the place of honor at the entrance of a château, where every room recalls his memory. By another marriage, Chantilly passed into the possession of the Condé; it was part of the dowry of that Charlotte de Montmorency who wedded with Prince Henri II de Condé inspired so violent a passion in Henri Quatre, then a sexagenarian, that her husband thought the only safeguard to his honor was absence from the Court, and so eloped with his own wife to foreign parts. At the death — always attributed to crime — of the last Prince of Condé, in 1830, the Duc d'Aumale, his nephew, became heir to all the property, which, fearing confiscation, he turned over, by a fictitious sale, in 1852, to the English bankers, Coutts & Co., for the sum of 11,000,000 frs. In 1860 a map of the estate was engraved by M. Rhitoré, but this document is no longer exact, as, since his return in 1872, the Duke has made several important additions and a few small sales, which have materially altered its physiognomy. The most valuable portion of the domain is, as it always has been, its forests. North of the château there is the Parc du Grand Bois; south of it the Fôret du Chantilly, of Pontarmé, of the Lys, of Coye, and the Bois de l'Aigle, and of Royaumont, in all a superficies of over fifty square miles. These have been divided by the Duke into two parts, one of which is inalienable, another which the Institute may sell or keep as its members may elect. The first is considered by the Prince as a specimen of the management of woods and forests, which ought to be preserved like the monuments and collections forming the Condé Museum. Its limits are not yet definitely fixed, but they will in any case include within them the Grand Parc, the château with its dependencies, the forest of Chantilly, and probably that of Pontarmé. The total value of the inalienable part is estimated at 4,000,000 frs., and is about eight thousand acres in extent.

The ancient château of Chantilly was a feudal fortress, which, though altered and touched up by each of its successive owners, never entirely lost its harsh and massive aspect, and, having the appearance of a bastile, did not suit revolutionary ideas, so it was demolished by order of the Convention. But Constable Anne had had constructed close to the old building the little château or châtelet, which, though found great fault with by architectural purists, is an elegant edifice. The great Condé intrusted the laying out of the gardens and parterres to Le Nôtre, and although in the next century the latter were replaced by a *jardin anglais*, the splendid perspectives and the ornamental ponds and lawns were left untouched, and it is said, were so much admired by Louis XIV, that they were taken as models in the arrangement of the pleasure-grounds of Versailles. The stables, erected by a great-grandson of the great Condé, are among the finest specimens extant of French architecture at the commencement of the eighteenth century, and have often been mistaken, so monumental are they, for the château itself, by strangers who have begun their visit on the west side of the palace. Fortunately neither the châtelet nor the stables were destroyed by the agents of MM. Marat, Robespierre & Co. The property was restored to the Condés in 1815, and as Ecouen, which also belonged to them, had been given by Napoleon to the Legion of Honor — a school for the daughters of *legionaires* was established by him there and is still preserved — was left to the order, all the works of art originally there, which had been saved by Alexandre Lenoir, were transported to Chantilly, although not reclaimed by the last of the Condés, who was so little of a *dilettante* that, after his death the famous Psyche glass was found still in the packing-box where it had been put fifteen years before.

The Duke demanded of the Architect Duban in 1845 a "project" for the reconstruction of the château, but only in 1875 was its execution achieved by M. Daumet, who, in spite of the difficulties of

his task, succeeded admirably in the construction of a beautiful monument, in which there is a very harmonious continuation of the Renaissance style with certain details of the old feudal fortress, that ought to serve as an example to French architects, who for the last thirty years have covered the soil of Gaul with insipid, naked surfaces, baptized by them the Neo-Grec. The building was finished in 1883, but the ornamentation, intrusted to the sculptors Marqueste, Barthélemy, Wahnul and Maniglier, the painters Paul Baudry, Guiffart, and Le chevalier Chuignard, and the glass founder Bardon, is still incomplete. It has already cost 4,000,000 frs., and 600,000 frs. will scarcely be sufficient to pay the balance of the bill, and it was in order to insure the achievement of his undertaking that the Duke has retained the usufruct of the property, which the Institute was likely to let go to rack and ruin, as had happened for the châtelet, on which 1,000,000 francs has been expended, where such was the dilapidation that the Emperor Alexander, who was lodged there in 1815, always kept his umbrella open in the dining-room. The statuary in the garden has also cost a great deal of money. You see there the figure of the great Condé, surrounded by those of the artists and writers whom the victor of Rocroy had as his most familiar guests; La Bruyère, by Thomas; Le Nôtre and Molière, by Tony Noël; Bossuet, whose pedestal will be occupied whenever M. Guillaume shall have finished the statue. At the foot of the grand staircase are the mythological statues of Pluto and Proserpine, by Chapu, and in the court of honor the equestrian effigy of the Constable Anne de Montmorency, by Dubois, of which a copy reduced to three-fifths was exhibited at the last *Salon*. All of these are estimated to have cost at least 2,000,000 more, although the total value of the reconstruction and restoration is set down in the inventory of the domain at only 2,500,000 frs. By this example alone you can judge how much below the real figures have been all previous estimates. From positive documentary evidence it can be asserted that the true value exceeds 43,000,000 frs., 3,000,000 more than the sum restored to the d'Orleans family in virtue of the National Assembly's decree in 1872. — *C. T., in the New York Times.*

SOCIETIES

THE PHILADELPHIA CHAPTER, A. I. A.

AT the regular annual meeting of the Philadelphia Chapter, A. I. A., the following officers were elected: President, Theophilus P. Chandler, Jr.; Vice-President, Edward Hazlehurst; Treasurer, John Stewardson; Secretary, Arthur Truscott; Executive Committee, Messrs. Charles Balderston, Walter Cope, James H. Windrim.

COMMUNICATIONS

MILL FLOORS.

BOSTON, MASS., October 29, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Having lately examined several of the buildings which are now in progress in Boston, in which the floors and roofs are constructed after the principles now recognized as "*the mill or factory floor*," with heavy timbers wide apart, covered with thick plank, I observe one or two variations from the customary mill plan of which I beg to ask an explanation. There may be very good reasons for the principal variation but they are not apparent to me.

In the customary mill-floor the spans from wall to post, or from post to post crossway of the building, vary from twenty to twenty-five feet — seldom exceeding twenty-two feet; the beams are customarily placed either eight feet on centres, or ten feet four inches on centres, each set of beams resting directly upon the posts sustained by cast-iron caps, and not upon longitudinal girders. When the width on centres is eight feet, three-inch plank and one-inch top floor are customarily used for the floor proper: when the width is ten feet four inches, four-inch plank is used in place of three inch. These spacings have been adjusted to the conditions of setting textile machinery. Eleven feet on centres may be permitted with four-inch plank.

In some of the buildings which are being constructed for warehouse purposes, I find a different arrangement.

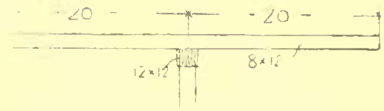
Assuming the building to be forty feet wide, the posts are set twelve feet apart; through the centre a heavy girder is placed upon these posts, and moderately-heavy floor-timbers are set about five feet apart on centres, from this girder to the wall. The objections to this course are as follows: *first*, the lesser number of posts; *second*, a heavy longitudinal girder exposed upon the top to dust, and in some measure interfering with light when the light is taken from either side of the building; *third*, a large additional amount of timber subject to combustion, and exposed at four corners; *fourth*, the placing of the floor timbers proper five feet apart is entirely inconsistent with the best adjustment of sprinklers, if the building is to be protected with any kind of sprinkling apparatus.

It is doubtless true that this disposition of the material may be theoretically a little stronger than the ordinary mill-floor, unless the sizes of the timbers used in ordinary mill construction should be slightly increased; and no exception may be taken to this plan where very heavy weights are to be put upon the floor, but for all ordinary purposes the mill construction would seem to be a better one.

In order that I may bring this point out with sufficient clearness, I have requested our Mr Woodbury to compute the strength of four different floors, on a factor of safety of six (6).

FLOORS. 40 × 100

Case 1.



Beams: 5 feet on centres.

Posts: 12 feet on centres.

Modulus of rupture for Southern pine divided by the factor of safety, $\frac{12960}{6} = 2160$

Material.	B. M.
2″ spruce flooring	8000
1″ hardwood "	4000
42 Southern pine beams 20′×8″×12″	6720
1 stringer beam 100′×12″×12″	1200
	19,920

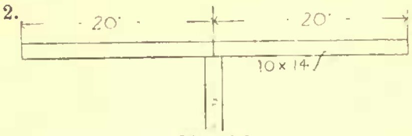
8000 feet spruce	20000 lbs.
10720 " hardwood	42880 "
	4000)62880
Weight of floor per square foot	15.72 lbs.

Strength per square foot:

$$W = \frac{Rbh^2}{9fsl^2} = \frac{12960 \times 8 \times 12 \times 12}{9 \times 6 \times 5 \times 20 \times 20} = 138.24 \text{ lbs.}$$

Deduct weight of floor	15.72
Safe load on floor per square foot	120.52

Case 2.



Beams: 10 feet on centres.

Material.	B. M.
3″ spruce	12000
1″ hardwood	4000
22 pieces Southern pine 20′×10″×14″	5134
	21,134

12000 feet spruce @ 2½	30000 lbs.
9134 " hardwood @ 4	36536 "
	4000)66536
Weight of floor per square foot	16.63 lbs.

Strength,

$$W = \frac{Rbh^2}{9fsl^2} = \frac{12960 \times 10 \times 14 \times 14}{9 \times 6 \times 10 \times 20 \times 20} = 117.69 \text{ lbs.}$$

Deduct weight of floor	16.63
Safe load per square foot of floor	101.06

Case 3.



Beams: 10 feet on centres.

Material.	B. M.
3″ spruce	12000
1″ hardwood	4000
22 pieces Southern pine 12″×12″×20	5280
	21,280

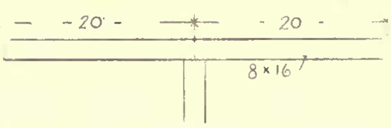
12000 feet Spruce @ 2½	30000
9280 " hardwood @ 4	37120
	4000)67120
Weight of floor per square foot	16.78 lbs.

Strength per square foot:

$$W = \frac{Rbh^2}{9fsl^2} = \frac{12960 \times 12 \times 12 \times 12}{9 \times 6 \times 10 \times 20 \times 20} = 103.64 \text{ lbs.}$$

Deduct weight of floor	16.78
Net load for floor per square foot	86.86

Case 4.



Beams: 10 feet on centres.

Material.	B. M.
3″ spruce	12000
1″ hardwood	4000
22 pieces Southern pine 8″×16″×20′	4693
	20,693

12000 feet spruce @ 2½	30000 lbs.
8693 " hardwood @ 4	34772 "
	4000)64772
Weight of floor per square foot	16.19 lbs.

Strength per square foot:

$$W = \frac{Rbh^2}{9fsl^2} = \frac{12960 \times 8 \times 16 \times 16}{9 \times 6 \times 10 \times 20 \times 20} = 132.88 \text{ lbs.}$$

Deduct weight of floor	16.19
Safe load per square foot of floor	106.69

Number one is the plan to which I have objected, unless the weight proposed to be put upon this floor requires this disposition of the material to assure extra strength.

The other three correspond to the rules which would be adopted in the different floors of an ordinary cotton-mill, which are not subject to a heavier weight in any part of the mill, under ordinary conditions, than about sixty pounds to the square foot, averaging not over twenty-five or thirty including the weight of the operatives, but not including the weight of the floor itself.

Will some of your correspondents kindly submit a statement of the weights or loads on which they are accustomed to compute the strength of the required floors in buildings which are intended for ordinary commercial purposes and not for the extra weight which is required in the storage of tin in boxes, cheese and glass, which I believe are the three substances customarily requiring the heaviest construction. This mode of construction with the inner ends of the beams resting upon a longitudinal girder instead of being placed immediately upon the post and iron caps was given up in factory construction about thirty years ago, by all well-trained mill engineers and constructors, for the reasons which have been given, and also for other reasons.

In any mill of several stories, the shrinkage of the actual floor timbers is a matter of consideration with reference to the alignment of the shafting, but where the opportunity for shrinkage is doubled by resting a fourteen or sixteen inch timber upon a girder of the same kind, the difficulty in keeping shafting well adjusted is doubled.

Moreover, the effect of a heavy weight resting upon the side of a timber is very much greater and more injurious than when the weight rests upon the metal cap interposed between the floor timber and the head of the post. This bad effect more than offsets the slight additional weight which may be placed upon the floor constructed according to form number one.

So far as mill construction is concerned, the system of longitudinal girders has been absolutely condemned as unsuitable both from the engineering point of view, with a view to light, with a view to economy of material, and with a view to safety. For what reasons is it adopted in the construction of warehouses?

The proverb that the strength of the chain is measured by that of its weakest part is equally applicable to all forms of construction; as the good Deacon whose versified construction of a "One-horse Shay," vowed that

"One thing is plain;
The weakest part must stand the strain."

There is no error which is more common in the construction of buildings of a few years ago, involving wooden columns, than to see a wooden column supporting a wooden cap; or what is worse, directly against a wooden beam.

The examinations made for this Company on the strength of columns, on the testing-machine at Watertown Arsenal, showed that the resistance of Southern pine columns to compression averages about 4450 lbs. to the square inch; while the transverse resistance of Southern pine to crushing was about 1750 lbs. to the square inch, or about forty per cent. Therefore, a wooden column directly supporting wooden beams should have an iron cap at least two-and-a-half times the area of the cross section of the column, in order that the longitudinal resistance of the column and the lateral resistance of the beams should be required to resist intensity of pressure proportional to their strength in both instances.

Yours very truly, Edward Atkinson.

VENTILATING ROOF-SPACES.

Boston.

To the Editors of the American Architect: —

Dear Sirs, — I have under my charge a brick building 55′ deep, with composition roof pitching to rear. The question arises as to whether or not the space between roof and ceiling of upper story should be ventilated. I hold that if the space is opened at front and rear, the volume of heated air rising from the pavements will be drawn into it, while, if kept closed, the confined air would act as a non-conductor between the heated roof and ceiling. My position is questioned; will you be kind enough to decide which is the best practice? Very truly yours, H. Z. L.

[It is best to ventilate the air-space between roof and ceiling. The notion that the air, if confined, will act as a non-conductor, although common, is fallacious. On the contrary, the reverberation of heat between the roof and the upper surface of the ceiling raises the confined air to a very high temperature, which is communicated by convection and diffusion to the room beneath. If a good ventilation is kept up, the temperature of the air-space will never rise much above that of the air outside, and the room will receive little or no heat from the roof. — Eds. American Architect.]

A Large Glycerine Barometer. — The largest barometer in this country is that contrived by Zophar Mills at his office, 146 Front Street, New York. So far as Mr. Mills knows his is one of three glycerine barometers in the world. There is one in London and one in Scotland. Mr. Mills has had a glass tube drawn 31 feel long and with an outside diameter of 3½ inches. The inside measurement or bore is just an inch. It was hoisted to the roof of the Front-street building, and a hole large enough to admit the tube was bored through the roof and down through the several floors to the cellar. The tube was carefully lowered through this hole and suspended by a brass collar against the wall in Mr. Mills's office, which is on the second floor. The lower end of the tube hangs in a cistern filled with glycerine in the floor of the cellar. The advantages of Mr. Mills's big barometer are these. It is so big that slight variations can be read at sight and can be seen from a distance and at a glance; the variation in movement is not only great, but it is quick, and Mr. Mills thinks his big barometer will give a hint of coming storms two or three hours before a mercurial barometer will show a depression. — *Springfield Republican.*

TRADE SURVEYS

A simple statement of transactions in iron, steel, lumber, coal, cotton, wool, petroleum, and in some other of the leading staple productions of the country for the past week would in themselves be a sufficiently full presentation of the existing industrial conditions. To put the case in a nut-shell, an enormous amount of business has been transacted; prices in nearly all these products are slightly higher than they were a week ago. By way of prediction, it may be said that the probabilities to-day point to a slightly higher range during the next two or three weeks. The reasons for this statement are these: that the fullest production in our industries are promptly absorbed, that orders are increasing in number and magnitude, that new schemes calling for supplies of all kinds are constantly coming to the surface, and that there are increasing assurances every day that the present productive capacity is not in danger of overcrowding the markets. There are a multitude of other minor points which are entitled to some attention; only two or three of them will be referred to. One of them is, and perhaps the most important to the building interests, that a large amount of real estate has changed hands during the past month in the interest of projectors who contemplate erection of dwellings. Advices from several Western cities and some towns show that this policy of purchasing land for building purposes is quite general, and a great deal of land continues to be bought up in the vicinity of New York and Brooklyn. The same is true at Philadelphia. No less than a dozen schemes have recently gone through, and preparations are being made by the projectors for the erection of houses next season to cost from two to three thousand each. The same activity is observable in Chicago and in some other Western cities. This activity in lots for building purposes means a good deal more than appears on the surface. It points to the fact that property is advancing, that the industries are upon a very safe footing, and that manufacturers and builders have confidence in the existing trade foundations. Another point deserving of attention is the fact, and a by no means insignificant one, that railroad builders have finally determined upon the building of an immense amount of mileage next season. The word immense is used advisably. A summary of the enterprises announced in railway journals and in our leading dailies, justifies the statement to all appearances, and railway building is at hand. All of the trunk lines are engaged in schemes of extension of mileage. Nearly all of the Western roads have schemes on hand looking to the building of new roads, long and short. During the past week nearly 100,000 tons of steel rails were contracted for. For ordinary lots prices have advanced 50 cents, but for the danger of importation prices would advance $2 per ton. Even as it is, contracts were placed last week for 40,000 tons to be delivered at New Orleans.

The smaller industries also present encouraging features, and wood-working machinery interests are crowded with orders, and car-builders have lately been obliged to ask a delay upon business presented to them. The bridge-builders have contracts for between three and four months' output. The Western manufacturers of agricultural implements have felt the improvement to such an extent that for two or three weeks past they have been crowding in material, and, in consequence, merchant-steel has advanced five to ten per cent in the West. Reference has been made heretofore to the improvement of money-lending facilities between the East and West. During the past few months several large financial institutions have completed arrangements by which loans can be made in small or large sums to Western borrowers. This tendency has been stimulated by the difficulty of finding profitable employment for money in the East, and by the low rates ruling here. It is reasonable to predict that more attention will hereafter be given to the financial needs of the people in the West and South. Notwithstanding the outflow of the West, financial reports show a steady inflow from the business-distributing centres of the West to Eastern financial centres. The building statistics for the past week of both East and West show that activity has fallen off very little. Architects are already consulted upon building schemes for the coming year in some of the Western States. The indications point to some very heavy operations in manufacturing directions. Companies have been incorporated to push manufacturing upon large scale in the States between Ohio and Wisconsin. The leading industries have not been in so vigorous a condition as at present. Margins are gradually widening, confidence is increasing in the permanency of markets. The coal trade has recovered from a slight despondency, and producing companies both East and West are now crowded with orders which cannot be filled promptly on account of the scarcity of cars. Lumbermen and iron-makers indulge in the same complaint as to the scarcity of rolling-stock. The lumber-trade is very active in all markets, and, notwithstanding the heavy arrivals from both the West and South, stocks in Atlantic ports are rather light. Stronger lumber quotations are probable. That which most interests builders and architects at present is the probable course of prices of materials for the coming season. The highest authorities in the New England States adhere to previously expressed opinions that there will be very little, if any, advance, and give, as a reason, that the legitimate reasons for strengthening prices is about exhausted, and that with our enormous producing capacity any speculative advance is out of the question. The builders and manufacturing interests in the Middle States are extremely busy, but much of the business now placed is for winter and spring delivery, especially in the iron and steel industries. The belief is entertained that this policy of anticipating requirements several months will not be continued, and that, therefore, a temporary relaxing of demand will be encountered in mid-winter. This, however, is a reasonable one; the expansion of demand during the past six months has been too rapid and great to continue excepting in the one production of railway material, but due credit must be given to this very strong factor. Already rails enough have been sold to be made next year to lay between six and seven thousand miles of road. So far this year our railway construction foots up 6,000 miles as against only 2,325 miles at the same time last year. The railroad builders are making no mistake. The published gross earnings for October of 89 roads as compared with October last year shows an increase of nearly $2,000,000, and for ten months the increase is over $20,000,000 as against last year on 82 roads. The present strong features of the markets are, in a nut-shell, this: that material is in moderate supply, that prices are hardening, and that no probable causes are at work to interfere with the upward tendencies in every field of enterprise.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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CONTENTS

A GOOD deal of discussion is just now going on in the Boston papers about the new building for the Public Library of that city. Some time ago, an appropriation having een made by the City Government for the construction of the uilding, a competition was announced for plans, which were equired to conform to a scheme drawn up with much pains, nd with no small amount of understanding of the subject, by ie Trustees of the Library. The terms of the competition, articularly as to the ownership of the competing drawings, did ot accord with the ideas now accepted in the profession, and ie Boston architects generally took no part in the affair. . certain number of drawings were, however, sent in. Most f these followed the directions of the Trustees' circular as to lanning and arrangement, but there were one or two, the uthors of which had ventured to disregard these directions in oints where their trained judgment showed that the Trustees' roposed arrangement could be improved upon. There was ertainly nothing surprising in the fact that a skilful profesonal man, by studying over a problem, should be able to disover a solution which should be in some respects better than ie tentative scheme laid down by the Trustees, and the latter, 'ho do not seem to have placed too high a value on their own apacity, were disposed to award their premiums to the plans 'hich they perceived to be better than their own, but were opped by the City Solicitor, who warned them that their cirular of instructions, instead of being simply a collection of iggestions, as they seem to have intended it to be, formed, by s wording, a definite series of stipulations as to the character f the designs required, which not only excluded from consideraon all drawings in which these stipulations were violated, but bliged the Trustees to award their premiums, which were very beral, to plans which were now acknowledged to be less suitble for the building than those which they were debarred from onsidering. Architects, who frequently experience the necesty for a strict compliance with published terms of competition, 'ill easily perceive that this reasoning was conclusive; and the 'rustees yielded honorably to what could hardly have been therwise than a rather mortifying disappointment, and dis'ibuted their prizes among the authors of the best of the degns in which their directions were followed.

AS none of these designs, or any others at the disposal of the city, were quite suitable for execution, the Trustees finally applied to the City Architect to prepare plans under their irection, and, in accordance with floor plans so made, the foundaons of the building have been put in. So far, however, nothing as been made public as to the character of the design for the exerior, and some of the citizens, very properly feeling that a costly ublic building, on what is perhaps the most conspicuous site in ie town, next to that on which the State-House stands, ought to be a first-rate example of that architectural art which the profession in Boston can justly claim to have, done so much to develop, have, both in public and in private expressed the wish that some assurance should be given that the design of the structure should be the best that the city can furnish. In this they do not for a moment call in question the talents of the City Architect, but believe that if it is possible to secure a more artistic treatment of the subject than he could give it, the city should endeavor to do so, and for this purpose they propose either that some architect of more conspicuous artistic reputation than the City Architect should be at once employed to complete the building, or that the method in use in all other civilized communities, of inviting competitive designs on such terms that architects of ability and character will be willing to compete, should be adopted. By this means, if any design can be produced better than that which the City Architect intends to make, the city will have the benefit of it; and if nobody else can make one as good, there will at least be an advantage in proving this, instead of leaving the citizens with the idea that the trustees of their library pay no attention to their perfectly legitimate wish to get the best building that they can for their money.

WE must say that we sympathize somewhat with the citizens in this matter. If there were any great saving of expense in having the building planned and executed under the care of the City Architect, there would be perhaps a reason for managing the affair in the way in which it has been carried on; but, independent of the fact that the very best professional advice, at least with regard to building operations, is always the cheapest in the end, it is tolerably certain, judging from the figures which have been published about the expenses of the City Architect's office, that the work which he does, or is likely to do, on the plans for the library, will cost the city quite as much as would be charged for the same service by a private architect, to say nothing of the fact that the City Architect is by his position simply an irresponsible official, having nothing at stake in the correctness or adequacy of his plans, the consequence of any defects in which must be assumed by the city whose salaried employé he is; while the multitude of duties which crowd upon him must necessarily prevent him from giving to the work of executing them that close personal supervision which a private architect is held, by his knowledge of his accountability for negligence, as well as his habits of practice, to bestow upon his buildings. We feel that we cast no reflection upon the present City Architect, whose efficiency and industry we know well, in saying that the observations which we were able to make during a short visit to the site of the library building not long ago suggested to us that there was serious need of such supervision of the operations being carried on there as only an architect, familiar with the whole structure of the intended building, can give; and, as it is plainly impossible for the busy City Architect to afford the time necessary for such supervision, and injudicious, to say the least, to delegate it to subordinates, it is hard to avoid the inference that it would be found in Boston, as it already has in other civilized places, most prudent in the end to commit such work to private and responsible professional men, who can give to it the attention that it requires.

THE great competition for designs for a new front for the Cathedral of Milan is soon to be decided, and the jury has already been appointed. The first member of the jury is Don Antonio Ceruti, of the Ambrosian Library at Milan; and the second is Signor Carlo Ermes Visconti, of Milan, who is nominated by the governors of the Cathedral, and will act as the president of the jury; and then come Professor Boito of Milan, an architect, and Professor Bartini, a painter, both nominated by the City Council of Milan. Four more architects, Sig. Giacomo Franco of Venice, Baron von Schmidt of Vienna, Mr. Alfred Waterhouse of London, and M. Ferdinand de Darteine Marie, as the *Deutsche Bauzeitung* calls him, of Paris, are named by the Royal Academy of Fine Arts in Milan; and three more members, Professor Clericetti, Signor Cantu, and Signor Brioschi, all of Milan, are chosen by various scientific and artistic bodies in the city. For the information of the jury, the Cathedral Commission has placed at its disposal a great collection of drawings, photographs and

designs of all sorts relating to the building, and it seems in every way likely that the competition will be a successful one. We know much less about the Italian members of the jury than the others, but if the selection of them has been made with the admirable judgment which suggested the appointment of Mr. Waterhouse and Baron Schmidt, their verdict will command the respect of the whole artistic world.

ACCORDING to *Le Génie Civil*, the United States have reason to be proud of rivalling, in one important industry, any other nation in the world. No doubt the enormous extent of our country, with our activity in railroad building, have contributed to develop the manufacture of locomotive engines, but something more is probably due to the natural ingenuity of Americans, and their fondness for mechanical pursuits of a higher class, and at present the Baldwin Locomotive Works of Philadelphia far surpass any others in the world in the extent of their business, making every year six hundred engines. The largest establishment of the kind in Europe is the Borsig factory at Berlin, which turns out three hundred engines a year, and sends them to all parts of the Continent. England, which manufactures for her colonies as well as herself, produces twenty-two hundred locomotives, and Germany about two thousand, while France makes one thousand, and Russia, with its great territory, only forty. It is rather surprising to find that Austria, which is usually regarded as a torpid agricultural country, makes nearly as many locomotives in a year as Belgium, the most industrious and thickly-settled country in Europe as well as the centre of the great transportation lines between Great Britain and the Continent.

THE *Scientific American* calls attention to the fact that M. Sainte-Claire Deville, the great French chemist and metallurgist, has recently discovered that certain compounds of hydrate of lime and hydrate of magnesia form a strongly hydraulic cement, and that dolomite, which is a natural compound of the carbonates of lime and magnesia, furnishes, by burning at a very low red heat, and grinding, a quick-setting hydraulic cement, which becomes so hard that it may be employed as an artificial stone. As dolomite is a very common mineral, this discovery has considerable importance, and it seems not at all impossible that districts which are now obliged to import hydraulic cements at a high price might, by a little persevering study of the process, be abundantly supplied with a tolerably good substitute for them. In many parts of our Eastern and Middle States, for instance, dolomite exists in enormous quantities, and although in some cases a far superior cement stone lies close by, there are other places where none of this has been found.

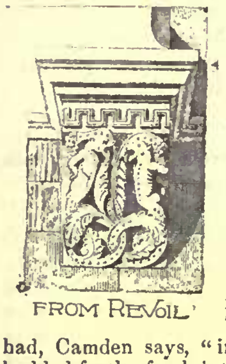
WITHIN the past few years several towns in the Western States have been experimenting with street pavements of brick. Many miles of brick pavement, it is needless to say, exist in Holland, and, if we are not mistaken, there are remains of brick in the streets of Nantucket, but elsewhere in the United States this material has been rarely, if ever before, used for the purpose. According to the *Engineering News*, Bloomington deserves the credit of being the first modern town in this country to introduce brick paving on an extensive scale. The town is situated in a clay region, and bricks are cheap there, as well as good, and by careful selection of material it has been found possible to produce bricks so tough and hard that in Bloomington, where seven miles of streets are now laid with them, they have been found, after ten years' experience, durable, as well as cheap and convenient. In Amsterdam, where, although canals intersect the city in all directions, a good deal of traffic is carried on by means of horses and wagons, the pavements of small, whitish bricks show little sign of wear, and, partly on account of their porosity, and partly from the numerous joints which exist between them, they are in wet weather much dryer and pleasanter to walk over than stone, or even asphalt. In the Illinois towns, the street is prepared for paving by forming the natural surface into the proper profile; on this is then laid four inches of coarse sand or cinders, evenly spread, cinders being preferred, on account of the better drainage which they afford, and the whole is covered with bricks laid flat, with joints as close as possible, and accurately formed to the desired profile. Fine sand is then spread over the surface, and worked well into the joints with a broom, and, after laying an inch more of sand over it, the top course, consisting of bricks on edge, is set, as closely as possible, and the joints of this also well filled with sand. The multiplicity of joints makes the pavement easy and safe for horses to travel over, and the whole cost is only from one dollar and forty cents to one dollar and eighty cents per square yard.

THE subject of the preservation of wood by impregnating it with tar, has been called to mind again by a discussion in the Association of Civil Engineers in London, and M. Le Blanc, in commenting upon the discussion in the *Revue Industrielle*, calls to mind the fact that long ago M. Melsens, a member of the Academy of Sciences of Belgium, described some experiments, which, following the indications derived from the study of the bituminous and resinous preservation used in embalming by the Egyptians, he had made upon pieces of wood saturated with tar. In 1841, several sticks, about sixteen inches long and ten in diameter, were impregnated with gas-tar by heating them repeatedly, plunging them in melted tar, and allowing them to cool. After this preparation, the sticks were buried in a damp corner of a garden, and left there for two years. At the end of that time they were split, and found to show white streaks, where the tar had not penetrated the wood. The pieces were then buried again for several years; then taken up and kept eighteen months in a dry place; then placed in a bath of live steam for twelve hours, cooled by plunging in water, and afterwards frozen; then left on the grass for a long time, and afterwards exposed on the flat roof of a house; then buried again in sandy soil mixed with mortar for six years; and finally placed on supports under a rain-water hogshead. After twenty years of this sort of treatment, the wood was found in perfect condition, showing no sign whatever of alteration. The inference which M. Melsens drew from this was, that an injection of tar, however made, preserves the wood which it touches, and he proposed that instead of simply charring posts to be set in the ground, they should be dipped in very hot tar, which would vaporize the water in the pores, and enter afterwards the vacuum formed by the dissipation or condensation of this vapor.

ACCORDING to the Vienna *Bauindustrie-Zeitung*, the Russian Government is fully resolved upon the construction of a railway from Russia to China, and has recently summoned to St. Petersburg the Governors of Eastern Siberia and the Amoor Province, to consult upon the details of the undertaking. The only doubt seems now to be as to the starting-point at the Russian end, but it is understood the Government favors making the terminus at Ekaterinoslav, near Odessa, from which there is already a railway to Orenburg, on the border of Asia. From Orenburg the line would run nearly east to Tomsk, the most important town in the most populous province of Siberia, and then by the great caravan route, one of the oldest and most frequented in the world, to Irkoutsk and Kiachta, on the Chinese frontier. From Kiachta the road is to run southerly to Ourga, at the edge of the Chinese desert, and from there to Pekin nearly in a straight line; and from Pekin it is intended ultimately to extend the road to Shanghai. Altogether, the railway will be nearly six thousand miles in length, but about twelve hundred miles is already constructed. So far as the topography of the country is concerned, there will be no serious difficulties to be overcome until the Chinese frontier is reached, but the climate is likely to make both the construction and maintenance of the line somewhat costly, the thermometer, over a larger portion of Siberia, often falling to sixty below zero of Fahrenheit's thermometer, while in many provinces mercury in the open air usually remains frozen for two months out of every year. The Russians, however, are not much afraid of the cold, and the enterprise and determination which have founded such cities as Irkoutsk, with its population of nearly two hundred thousand souls, in the middle of these frozen plains, will not be likely to quail before the difficulties of an enterprise which promises so much for the future prosperity of the Empire. Whatever may be said of the ambition of Russia, her restless, active spirit is of no small value in the world, and if she should really succeed in establishing, as seems not unlikely, not only the railway from St. Petersburg to India, which is already within a few hundred miles of accomplishment, but a line to China, she may justly claim to be the leader of the world in material progress.

PARIS CHURCHES. — III.

ST. GERMAIN DES PRES.


FROM REVOIL'

THE Abbey of St. Germain, of which nothing remains but the church and the abbot's palace, was, after Notre Dame, the oldest foundation in Paris. It dates back to the earliest period of French monarchy, and its history is mixed up with that of some of France's best and noblest sons. The St. Germain, to whom the church was dedicated, was an early bishop of Paris, and must not be confounded with St. Germain or Germanus, bishop of Auxerre, who discovered the holiness of Ste. Geneviève when passing through Paris *en route* for Britain, where he had been invited to a synod with Lupus, bishop of Troies, to refute the Pelagian heresy, which had, Camden says, "in the year of the World's Redemption 429, budded forth afresh into this island." The monastery was founded by Childebert I, at the instigation of the Saint in this wise: It appears that the king, returning from a second expedition against the Visigoths in Spain (531–543), had brought with him much loot of various kinds — St. Vincent's tunic, a rich gold cross ornamented with precious stones from Toledo, some vases said to have belonged to King Solomon, and a quantity of chalices, patens and golden covers for the Gospels: what could be more natural in the sixth century than to build a church to contain these treasures, and to found a monastery whose inmates should protect them? Accordingly, Childebert agreed to carry out the suggestion of the bishop, and the first stone of the abbey was laid amid the green fields which have now developed into the densely-populated Faubourg St. Germain. The enclosure extended from the Rue Jacob, on the north, to the Rue Ste. Marguerite, on the south, while the eastern and western bounderies were the present Rue Lachaudé and the Rue Bonaparte. The buildings within the precincts were very numerous; indeed, they formed a city in themselves, and were originally surrounded by walls and a moat, which was filled by the waters of the Seine. There were three gates: the Petit-Bourbon, Ste. Marguerite, and St. Benoit. The latter still remains, ornamented by an architrave supported by Ionic columns. The church was originally dedicated by St. Germain to the Holy Cross and St. Vincent, the ceremony taking place upon the very day of the death of Childebert, in 558. It was a cruciform edifice supported by enormous marble columns, pierced with numberless windows, and covered with gold. Paintings on gold grounds embellished the walls. The pavement was mosaic, and the roofs were covered with plaques of gilt copper.

St. Germain dying in 576, his body was buried in the chapel of St. Symphorien, at the end of the church; and it so happened that wondrous miracles and cures were effected at the tomb of the good bishop; so famous, in fact, did it become, that in course of time the abbey was known as that of St. Germain, its original patrons drifting into almost complete oblivion.


Bronze Statue of Daibutsu, Uyena, Japan.

The church served as the burial-place of the Merovingian Kings until the foundation of St. Denis by Dagobert. Thus, during the sixth and seventh centuries the following princes were interred here; the kings Childebert I, Chérebert, Chilpéric I, Clotaire II, and Childéric II; the queens Ultrogothe, Frédégonde, Bertrude, and Bilihilde; the sons of the kings Mérovée, Clovis, and Dagobert, and the princesses Chrodesinde and Chrotberge, daughters of Childebert I. In his "*History of the Abbey*" Dom Bouillart gives an account of the openings of some of these tombs. The bodies, it appears, were enclosed in stone coffins without exterior ornament, and nearly all of them were enveloped in shrouds of silk and other precious stuffs — some of them reposed on beds of odorous herbs, others were surrounded by viols of aromatic scents. Relics of all kinds were found in the coffins, stuffs embroidered in gold, fragments of cross-belts, and foot gear.

The monks whom St. Germain established in the monastery came from St. Symphorien at Autun, and followed the rules of St. Anthony and St. Basil; but shortly after the foundation they adopted the rule of St. Benedict, the great legislator of the monks of the West. In the seventeenth century a second reform took place, that of St. Maur, and it was after this return to primitive discipline that the monks of the abbey became famous throughout Europe by the works of Jean Mabillon, Bernard de Montfaucon, Bouquet, Calmet, and Félibien. Formerly the abbots exercised spiritual and temporal jurisdiction over the whole of what is now the Faubourg St. Germain; but in later times their power was restricted to the immediate precincts of the abbey. Jealousies occurred here, as elsewhere, between the ecclesiastical and other lay element, between the mitred abbots and the bishops. Amongst the former were many cardinals, one of the kings of France, Hugues Capet, Jean Casimir, King of Poland, and several princes of the house of Bourbon.

During the incursions of the Normans upon Paris, the monastery was devastated, burnt, and pillaged at least four or five times: indeed, its situation outside the walls exposed it so much to the fury of the invaders that it required a century's patient labors to repair its disasters. Morard, the twenty-ninth abbot (990–1014) undertook the entire restoration of the church, and it is to him that we owe the oldest extant portions of the nave.

Situated as it was amidst what was termed the *près aux clercs*, or recreation ground for the students of the university, it was necessary that the monastic building should be surrounded by fortified walls and a moat, and protected from danger of assault by watch-towers and strong gates. Later, when danger from attack had passed away, streets took the place of the moat, and houses occupied the site of the fortifications. At the commencement of the last century the monks built several large houses from plans by Victor d' Ailly, which were occupied by the artisans who paid a heavy rent for the privileges they enjoyed of living within the precincts of the abbey. These habitations formed the Rues Childebert, Ste. Marthe, Cardinale, Abbatiale and de Furstemberg. There were originally two cloisters situated to the north of the church, but, with the exception of a portion of the larger one which is attached to the building, and which now forms divers apartments, they have been completely destroyed. The round arches and Doric pilasters belong to the seventeenth century; but the older portions, built by Abbot Eudes, were cut through and improved away by the formation of the Rue de l'Abbaye. The same street and its houses have also to answer for the destruction of the refectory, the chapel of the Virgin, the chapter-house and the great sacristy. The smaller cloister formed an entry into the chapel of the Virgin. The refectory, constructed during the life of Abbot Simon, was the work of the celebrated architect of the Sainte Chapelle, Pierre de Montereau, or Montereuil. It was a large building filled with stained glass bearing the arms of France and Castille, a little of which still remains in the church, and at St. Denis. The statue of Childebert, of stone, painted, which formerly stood at the entrance, is now in the Louvre (Renaissance museum, No. 70, in passage leading to the Salle de Michel-Colombe). Dom Jacques Bouillart, describing this refectory as built between 1239–44 remarks: "At the door they have placed a stone statue representing Childebert, apparently modelled upon a more ancient one." Pierre de Montereau was also the architect of the chapel of the Blessed Virgin, commenced under Abbot Hugues d' Issy, who died in 1247, and finished under Thomas de Mauléon, who resigned his dignities in 1255. This chapel had but one rival at Paris, the *chef d' œuvre* of its architecture, the Sainte Chapelle. Pierre died in 1266 and was buried in the chapel of his own creation; the then Abbot Gérard de Moret erecting handsome tombs to his memory and that of his wife, Agnès. The architect held a rule and compass in his hands, and had for epitaph *Flos plenus morum* and *Doctor latomorum.*

Passing along the Rue Bonaparte is the corner of a building which served as kitchen and guests' dormitory; and following the Rue de l'Abbaye to the left is one of the gables of the refectory, some pointed arches and little columns which probably formed part of the parlor and smaller cloisters. On the opposite side is the abbot's palace, a handsome red brick and stone edifice erected by the Cardinal de Bourbon, about 1586. At the summit of a pavilion is a figure of a woman bearing the arms of the founder on an escutcheon. Fragments of the chapel of the Virgin, columns, capitals, gargoyles, balustrades,

etc., were found in a garden hard by, and a figure of the Blessed Virgin was transported to St. Denis.

The gaol was rebuilt in the seventeenth century, and was flanked by four turrets. It was the scene of many horrors from time to time, the abbots possessing the power of punishing as well as of trying criminals; and in 1792 it was filled with priests and nobles who suffered for the crimes of their forefathers as well as for their own; amongst others Mlle. de Sombreuil. It afterwards became a military prison, and finally disappeared in 1854. The library was justly celebrated for its manuscripts, printed books and other objects of value; but was destroyed by fire at the commencement of the Revolution.

The only part of the church which contains any remains of Childebert's structure is the apse; into the triforium of which are built some early white marble capitals and some various-colored marble shafts; but inasmuch as they have been painted over, all interest in them is destroyed.

The earliest part of the present church dates from the beginning of the eleventh century, the choir and apse from the second half of the twelfth century. The best view of the apse with its flying-buttresses is to be obtained from the garden of the abbot's palace, but since the clearing away of the houses which formerly were almost built on to the church, and the planting of gardens round it, the view is picturesque from any point. An insignificant seventeenth-century porch leads to the west door, which is of the same date as the choir, and is surmounted by a much mutilated bas-relief of the Last Supper in the tympanum. The tower has been so much restored and renovated from time to time that little of the original remains. It has a high but stumpy spire covered with slates. Dom Bouillart relates that on the 2d November, 1589, Henri IV mounted to the top of the tower, accompanied by only one ecclesiastic, to examine the situation of Paris. "He afterwards walked round the cloisters, and without speaking one word, departed." Of the other two towers which were formerly at the angles of the choir and transepts, nothing remains but the bases, which were considered necessary for the support of the church. It seems that they were pulled down about 1822, to save the expense of their restoration! a piece of vandalism which destroyed the originality of the building and the *raison d'être* for its nickname of "the church *aux trois clochers*."

The building is 265 feet long, 65 feet broad and 59 feet high. The nave is divided into five bays, the choir into four, and the apse into five; but these latter are much narrower than those of the nave. In the seventeenth century, the timber roof of Abbot Morard gave place to a stone vault, the transepts were rebuilt and the nave much altered; but quite recently it has been restored to its primitive condition and decorated with frescos by Flandrin. The church having been used during the Revolution as a saltpetre manufactory, the corrosive waters had so undermined the foundations of the pillars, that they were obliged to be supported by enormous scaffoldings while the bases were repaired.

Most of the present capitals are copies of the twelve remaining original ones which were transferred to the garden of the Hôtel Cluny; but they are of very inferior workmanship. The subjects treated are various: angels, saints, the Lamb of God, Daniel surrounded by the lions, priests celebrating the Holy Mysteries, Samson breaking the jaw of the lion. The old capitals are rough but full of character, whereas the modern ones are utterly devoid of any. In the Hôtel Cluny may also be seen the upper part of an early ivory crozier belonging to the abbey, which was found in a coffin during some excavations in 1854 — also some fragments of stone coffins. The choir is almost as it was in the twelfth century. The dedication was celebrated by Pope Alexander III, on the 21st April, 1163; and on the same day Hubald, Bishop of Ostea, and three other bishops consecrated the apsidal chapels. The east end inclines towards the south-east, but Monsieur Guilherney ascribes this rather to difficulties of construction, which always occur when a new building is placed amongst older ones of which it is to be a part, than to the legend which attributes this arrangement (so common in mediæval churches) to the position of our Lord upon the Cross.

The columns resemble those of Notre Dame in their massiveness. All the arches of the choir and chapels are round, but those of the apse and clerestory are pointed. The capitals of these choir pillars are all worthy of study, being in the best style of the period, and full of the quaint symbolism of the Middle Ages. The bases are all ornamented with foliage; but between the second and third chapels on the south side is an example of ornament which is probably unique, viz., two slippers, one embroidered and one plain, evidently those of a bishop or abbot.

The original high altar, restored in 1704, has been completely destroyed; but in 1792 it still remained in all its pristine beauty and splendor. The frontal was copper-gilt, with silver-gilt figures under canopies. The *châsse* of St. Germain was in the form of a church, and enriched with precious stones. It was made in the time of Abbot Guillaume III in 1408–9, and contained 26 marks, 2 oz. of gold, 250 marks of silver, 260 precious stones and 197 pearls. The history of such stones and pearls, of all this silver and gold, would be interesting could it be traced since the probable breaking up and dispersion ninety years ago.

The Louvre contains some of the antique cipolin marble columns of the baldichino, which were brought from the ruins of a Roman town on the African coast in the reign of Louis XIV. The tomb of St. Germain, the scene of so many miracles, is no longer to be seen, having been covered up by the pavement. It was near the fourth column of the choir on the north side, and had been a favorite place for prayer, since the eleventh century.

The chapel of St. Symphorien, at the end of the nave on the south side, is modern, having been consecrated by St. François de Sales, on the 27th April, 1619, and the monument which marked the first burial place of St. Germain is no longer in it. The chapels of Ste. Marguerite and of St. Casimir, in the transept, are ornamented with marble columns. That of the Blessed Virgin is modern, in wretched taste; and the high altar is thoroughly out of keeping with the rest of the church. The first stone was laid by Pius VII.

In an apsidal chapel are some fragments of thirteenth-century glass, representing St. Anna and Joachim, the Annunciation and the Marriage of the Virgin. In the south side of the nave is a large marble statue, called Notre Dame la Blanche, given in 1340, by Jeanne d' Évreux to the Abbey of St. Denis. Placed at the Revolution, in the Musée des Petits-Augustins, it was afterward transferred to St. Germain. The marble statue of Ste. Marguerite is by one of the brothers of the convent, Jacques Bourlet; and that representing St. François Xavier, is by Couston, the younger. The tombs were restored in 1824, but not in the complete splendor of former times. The principal ones are the following: Jean Casimir, King of Poland, who became abbot in 1669, after having renounced his throne, and who died in 1672. The kneeling figure is by Marsy; the bas-relief by Jean Thibaut, of the Congregation of St. Maur. Olivier and Louis de Castellan, killed in the service of the king in 1644 and 1669, by Girardon. William Douglas, eighteenth Earl of Angus, who died in 1611, and his grandson James Douglas, killed in 1645, near Douai, aged twenty-eight. The epitaphs, which the Academy set up in 1819 to the memory of Nicolas Boileau, of René Descartes, of Jean Mabillon, and of Bernard de Montfaucon, which were formerly at the Musée des Petits-Augustins, were placed here on the suppression of that Museum. Boileau reposed formerly in the Sainte Chapelle, and Descartes at Ste. Geneviève. What remained of the royal tombs were transferred to St. Denis; of the riches of the Treasury nothing remained, it was all pillaged and dispersed.

The whole church has been painted in polychrome, and a series of frescos by Flandrin, decorate the nave, choir and transepts. Hippolyte Flandrin is one of the few nineteenth-century artists, who has shown himself capable of uniting the sentiment of the early painters with the knowledge of the moderns. His work is as purely religious in feeling, as it is academical in execution. His saints and angels are in expression equal to those of Giotto, Fra Angelico and Filippo Lippi; while his figures are as perfectly modelled as those of Titian and Tintoretto. But then Flandrin was a Catholic, and was not ashamed of calling himself a believer in the doctrines and mysteries of the Faith. The man who considered religious painting to be "the height of art, and the most worthy employment of genius," and who wrote upon the door of his studio, "Thou Lord, hast made me glad through Thy work; I will triumph in the works of Thy hands;" could not have been as a Christian, on a much lower level than Fra Angelico, who, history tells us, painted his pictures upon his knees. Flandrin was the favorite pupil of Ingres, and won the Grand Prix de Rome of 1832. Humble-minded, gentle, courageous, he worked for love, rather than for fame or money. His early struggles when he first arrived in Paris from his native place were terrible. He lived in a veritable garret with his brother, sacrificing anything in order to work at painting. Often in winter they went to bed at 5 o'clock in the afternoon to escape the cold of their attic. Their dinner was frequently some fried potatoes bought at stalls in the streets and squares; and it is probably to the privations endured for love of art that his bad health and early death may be attributed. But his enthusiasm carried him on; and he lived long enough to count his sacrifices as nothing compared to his successes. He stands out in this nineteenth century an example to all artists, and as the one man who can be compared to the blessed monk of Fiesole.

Not a little pleasant is it to find that Ingres when he heard of his pupils' forced asceticism, exclaimed — "And I was taking their money!" Indeed there are many anecdotes which prove as much the devotion of the pupils for the master, as the love of the master for the pupils. Many traits in Ingres's character come out in the history of Flandrin's early artistic career, which prove him to have been sympathetic to the highest degree. He was inconsolable the first time Flandrin failed to gain the Prix de Rome — "You have no notion how hard it is for a young man's hopes to be dashed to the ground!" he said to his wife; and he spoke of him as the "Lamb which had been slaughtered." He knew that it was unjust, and he felt the injustice as much as if it had been done to himself. The account Flandrin gives his brother Auguste of the whole affair is most touching, but too long to be related here. But we must not omit an anecdote of another sort, a quaint trait in the character of a gend'arme. Flandrin was in the habit of taking portraits for very small sums to eke out his existence, and he promised to do this man's for 30 frs. When it was finished the gen d'arme was so pleased that he exclaimed, "I promised you 30 frs., but here are 35!"

The choir was the first part of St. Germain which was decorated, and it is the most successful, the nave pictures being somewhat flat, and faded in color; but without the use of gold it was impossible to make the subjects effective with the bright polychrome surroundings, and Flandrin justly considered that the nave should be subordinate in splendor to the choir and sanctuary. On the right and left of the commencement of the choir are two large compositions, "Christ

entering into Jerusalem," and "The Way of the Cross," both on gold grounds. Above these are the twelve Apostles clothed in white, and the allegorical Virtues; and higher still are the founders of the church, Childebert and St. Germain, with the patron St. Vincent, Queen Ultrogothe, and Abbot Morard. The frescos of the nave occupy the space between the tops of the arches and the bases of the clerestory windows. Each arcade contains two pictures; in all twenty compositions. The subjects are from the history of Our Lord, and the corresponding Old Testament types and anti-types. Thus we see the "Annunciation," and the "Burning Bush," side by side with the text: "*Domine, mitte quem missurus es.*" Then comes the "Nativity," and the "Fall;" and the text: "*Per hominem mors, per hominum resurrectio.*" Next the "Adoration of the Magi" and "Balaam;" the "Baptism," and the "Passage of the Red Sea;" the "Institution of the Eucharist," and the "Priesthood of Melchizedech;" on the opposite side are: "The Treason of Judas," and "Joseph Sold by his Brethren;" the "Crucifixion," and the "Sacrifice of Isaac;" the "Resurrection," and "Jonah being ejected by the Whale;" the "Dispersion of the Apostles," and the "Building of Babel;" the "Ascension," and the "Last Judgment." Above these are numerous personages, single and in groups, from Adam downwards. All are conceived in the truest religious spirit, and although they may not all be equally vigorous, or equally good in color, yet of their beauty and nobility there is no question.

Flandrin died at Rome, whither he had gone for his health, on the 21st of March, 1864, and was buried at Père la Chaise; but the funeral service was held in the church he did so much to embellish, and on the left side of the nave, his friends placed a monument to his memory. The epitaph is scarcely in keeping with the man or the place.

A. HIPPOLYTE FLANDRIN.

"SES AMIS, SES ÉLEVES, SES ADMIRATEURS, LYON, 22, MARS, 1809, — ROME, 21, MARS, 1864."

Not one word of what he loved above all things, his home, his country, his art, and his God. S. BEALE.

THE WESTERN ASSOCIATION OF ARCHITECTS.



IN THE CLOISTER OF ST. SAUVEUR. AIX. FROM REVOIL

THE third annual meeting of the Western Association of Architects was held in Chicago, Wednesday, Thursday and Friday, November 17-19, at the assembly rooms of the Permanent Exchange and Exhibit of Building Materials, at 15 Washington Street.

FIRST SESSION.

President Dankmar Adler, of Chicago, called the Association to order at 11 o'clock, on Wednesday morning, and read his address, saying, in effect that: —

He welcomed the visiting architects, as president of the Illinois State Association. He felt grateful for the privilege of being part, not of a renaissance, but of a naissance in architecture, for he recegnized the birth of an American style of architecture, developed by the wants, conditions and limitations of the nineteenth century. The first work of a good architect is never the equal of his subsequent works. Compare Richardson's North Church at Springfield, or his American Express Company's Building at Chicago, with the North Easton Town-Hall, the Marshall Field Building in Chicago, or the Pittsburgh Court-House; compare Post's Troy Savings-Bank with the Produce-Exchange; compare Root's Riddle House with Byram House, or his Grannis Block with the Insurance Exchange or the Rookery Building, for proofs of this assertion. He referred to the work in America of the European architects who made this their home, and brought their methods and styles with them. Their work though good, was not American; but the influence of this work shows itself on our architects of to-day. Yet this European influence has been thoroughly Americanized. How thoroughly American is Post's Italian of the Produce Exchange. How American is Richardson's reproduction of the sombreness and dignity of the Palazzo Strozzi in the Marshall Field Building. How American is the application of Indian *motifs* in Root's ornamentation of the Rookery Building. How American are Sullivan's reminiscences of the training of the École des Beaux-Arts. This growth of a quarter of a century has called out unstinted praise from European critics. This praise however, applies only to our private work. Our governmental works are carefully excluded from favorable mention. This difference is due to the fact that in public work we find an alleged competition. In private work we find the real competition. In public work as the result of this so-called competition we have a picture, or at best, a plan, the mere shadowy presentment of partially evolved ideas, premiated and made the basis of the work to be executed; in the other case a living architect is selected to evolve and carry out living ideas. In private practice the architect becomes imbued with the enthusiasm of the client, and the client receives the benefit of this enthusiastic devotion. In a public competition this sympathetic enthusiasm is absent, and its benefit is lost to both sides. By active work this deeply-rooted evil must be extirpated. Before attacking this sham competition as applied to large work, let us correct the occasional lapses into it in private practice. To do this we must learn that the architect's functions are the application of his knowledge, taste and skill, and that he is not a vender of plans. In the most recent instance of a competition conducted as they best can be, we are told by the successful architects that they "began a study of the problem by laying out all plans that they could devise for such a building and such a lot. Their value as to exterior light was then compared, and the one herewith submitted giving the best results was therefore chosen." This is exactly what they would have done had this work come to them in their ordinary practice; but the element of personal enthusiasm between client and architect was lacking. As to the cost of this model competition? Forty-seven architects expended probably $25,000 in cash, or its equivalent, and a vast amount of vital energy all for the chance that one of them would be given the opportunity to expend $7,500 more, and earn $20,000, and the glory of having vanquished his fellows in fair and open combat. Such a method of doing business is not conducive to the elevation of the profession or the public. Public governmental buildings should, perhaps, be designed under free, honest and intelligent competitions, so that the best architects will compete in them. But the rescue of these competitions from the slough of corruption into which they have fallen, is a task of stupendous difficulty for this and kindred organizations. To accomplish this we must be united and true to each other, so that we may influence for good not only the national and other legislative bodies; but the great American people which creates and moves them all with resistless power, which no amount of corruption can withstand.

The Secretary called the roll, and sixty-nine members responded. A number of members who were also present were temporarily absent at roll-call.

The minutes of the last meeting were not read, as they had been widely published heretofore.

The Executive Committee recommended the following architects for membership: S. B. Abbott, of Springfield, Mo.; Fridolin Herr, Dubuque, Ia.; L. D. Grosvenor, Jackson, Mich.; S. E. Des Jardines, Cincinnati, O.; A. W. Hayward, Wichita, Kans.; C. B. Cook and John F. Cook, Chillicothe, O.; William N. Aiken, Cincinnati, O.; Mason Maury, Louisville, Ky.; E. B. Bassford, St. Paul, Minn.; W. J. Dodd, Louisville, Ky.; C. C. Burke, Memphis, Tenn. They were all elected members.

Mr. W. F. Hackney, of Des Moines, Ia., resigned as a member of the committee to visit the American Institute of Architects at its New York meeting.

Mr. W. W. Boyington reported that the committee on raising the standard of professional requirements for membership had not held a meeting during the year.

Mr. Adler, calling Mr. Sidney Smith, of Omaha, to the chair, made a report as chairman of the committee appointed to take charge of the bill governing the office of the Supervising Architect, in which he stated that in union with the Committee of the American Institute of Architects, a bill had been prepared, and was introduced into Congress, by the Hon. A. S. Hewitt. Mr. D. H. Burnham, of Chicago and himself, representing the Western Association, and Mr. A. J. Bloor, representing the Institute, went to Washington, and had a hearing before the Committee on Public Buildings and Grounds, but met with indifference. There seemed to be a fear that the free and general competition which has been one of the features of the proceedings would work detrimentally, perhaps, to the interests of local architects in the vicinities where public buildings might be erected. Mr. Bloor is informed by Mr. Hewitt, that there is no hope for the passage of the bill, unless there is a strong pressure brought to bear on Members of Congress by the press and by constituents. He recommended that efforts be kept up, and an endeavor made to push the bill to a passage in this or some subsequent Congress. The report was accepted, and the committee continued.

The members of the committee to represent the Association at the next meeting of the American Institute were announced as follows: Messrs. W. L. B. Jenney, Chicago, Ill.; J. F. Alexander, Lafayette, Ind.; John W. Root, Chicago, Ill.; Sidney Smith, Omaha, Neb.; J. G. Haskell, Topeka, Kans. The President was empowered to name substitutes for those unable to attend.

As Chairman of the Committee on Statutory Revision, Mr. Adler stated that no attempt had yet been made to get the bill before any Legislature. The bill has been printed, and he recommended that special committees be appointed by State associations to push the bill the coming winter in individual Legislatures. The report was accepted, and the reorganization ordered.

Mr. Adler suggested that the nominating of officers, and choosing a place for the next meeting, two things usually left until the close of the session, and then hurried through, be taken up earlier, and given the attention its importance deserved. His suggestions were afterwards embodied in a motion by Mr. I. Hodgson, and two committees of seven members each were appointed to place two tickets of officers and locations in the field to be voted on by printed ballot. The motion prevailed, and the chair appointed as committee number one: Messrs. J. F. Alexander, Lafayette, Ind.; L. S. Buffington, Minneapolis, Minn.; William Holabird and L. D. Cleaveland, Chicago, Ill.; C. C. Hellmers, Jr., St. Louis, Mo.; George W. Rapp,

Cincinnati, O., and Mrs. Louise Bethune, Buffalo, N. Y. As members of committee number two, the chair named: Messrs. D. W. Millard, St. Paul, Minn.; S. M. Randolph, Chicago, Ill.; E. H. Taylor, Des Moines, Io.; Sidney Smith, Omaha, Neb.; Samuel A. Treat, Chicago, Ill.; C. A. Curtin, Louisville, Ky.; P. P. Furber, St. Louis, Mo.

Adjournment was then taken until 2.30 P. M.

SECOND SESSION.

Mr. C. C. Hellmers, Jr., of St. Louis, moved that the President appoint a committee of three members from each State association to collect information in regard to legal decisions relating to building interests and that they report at the next annual convention. In the discussion which followed, he suggested that a little pamphlet of these decisions would often prevent an architect from getting into trouble. The idea was opposed by Mr. Ketcham, who desired to see the Western Association take the question up, but Mr. Hellmer's motion at length prevailed.

The executive committee recommended the following applicants for membership: J. F. Wing and M. S. Mahurin, of Fort Wayne, Ind.; Eugene S. Caukin, Los Angeles, Cal.; Geo. W. Thompson, Nashville, Tenn.; M. F. Isbell, Goshen, Ind.; J. M. Freese, Columbus, O.; and Bernard Vonnegut, Indianapolis. They were elected. The application of Mr. James King, of Huntingdon, W. Va., not being accompanied by any recommendation, was referred back to the executive committee.

Mr. Louis H. Sullivan, of Chicago, then read an essay on "Inspiration." It was an allegorical and poetical production which commanded close attention during the thirty minutes of its delivery. Mr. Sullivan prefaced this essay by saying that to write an essay on inspiration is like writing an essay on eyesight. It is something we all know about, but is very difficult to define. Therefore, he indulged in no definitions, but treated the subject in the language of metaphor. He divided the essay into three parts, being a direct appeal to nature, whence all our emotions and all our inspiration must come, taking nature in its most impressive and deepest phases—the phase of growth, the phase of decadence, and the inscrutable cause underlying both of these. Part first, was "Growth, a Spring Song;" part second, "Decadence, Autumn Reverie;" part third, "The Infinite, a Song of the Depths."

The committee on State organization reported as follows:—

"Your committee on State organization has the honor to report that in the prosecution of its labors it has met with a hearty and cordial coöperation. We have successfully organized State associations in the States of Minnesota, Iowa, Illinois, Nebraska, Kansas, Missouri, Ohio, Texas and Indiana, all of which are working in an harmonious and satisfactory manner. Mr. Harteau, your committee from Wisconsin, asks that one member from Milwaukee be added to his committee. Mr. Osgood, of Michigan, asks that one member from Detroit be added to his committee. Mrs. Bethune, your committee from New York, has organized a Buffalo society of architects, fourteen members, who are working in an harmonious manner, and has turned her attention to the various other cities in the State with prospects of success. We think best that this committee be continued until associations in every State are organized."

On motion of Mr. J. W. Yost, of Columbus, the report was accepted, and the committee continued.

Mr. Vonnegut, of Indianapolis, stated that the Indianapolis Society of Architects had presented a protest against the Indiana State Association and called for its reading. He was informed that the protest was being held back by the executive committee by request from both factions, in the hopes that the trouble might be adjusted.

It was suggested by Mr. Normand S. Patton, of Chicago, that as there had been an association formed in Milwaukee, that its leading spirit be appointed on the committee with Mr. Harteau, and the local association be broadened out into a State association.

Mr. John W. Root, of Chicago, offered the following important resolution:—

"Whereas, in the case of each building constructed from the designs and under the supervision of a member of this Association, the owner should be supplied with full data of all essential points involved in its construction.

"*Resolved*, That the executive committee have printed and mailed to each member of the Association a form, the object of which shall be to supply to the members, under the seal of the Association, a schedule of points in relation to which the executive committee deems it advisable that clients should be informed."

Mr. Root stated that when an architect had a building constructed for one purpose devoted to another, the measure of his responsibility was very difficult to estimate. Great damage may result by heedless overloading of a building designed for light manufacturing, when it is turned into a warehouse, and through no fault of the architect. The form should state all the essential points of structure in the building, its intended purpose, weights intended to be carried by floors, loads supposed to be delivered on the clay at the bottom of the foundations, character of columns, etc. In furnishing the owner with this blank, the architect should disclaim personal responsibility if the building is diverted from its original purpose without consultation with him. The resolution was unanimously carried, and the Association adjourned until 10 o'clock, A. M., on Thursday.

ILLUSTRATIONS

[Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

THE MANHATTAN STORAGE WAREHOUSE, FORTY-SECOND STREET, NEW YORK, N. Y. MR. JAMES E. WARE, ARCHITECT, NEW YORK, N. Y.

[Gelatine Print, issued only with the Imperial and Gelatine Editions.]

Plans and a description of this building will be found in our issue for February 2, 1884.

GRACE CHURCH, WEST FARMS, N. Y. MR. W. A. POTTER, ARCHITECT, NEW YORK, N. Y.

This church, exclusive of the windows — by Tiffany & Co. — and the oaken chancel furniture, which are gifts, cost $6,000. It will seat 200.

BITS IN AN OLD FARM-HOUSE, NATICK, MASS. SKETCHED BY MR. HENRY BACON, JR., BOSTON, MASS.

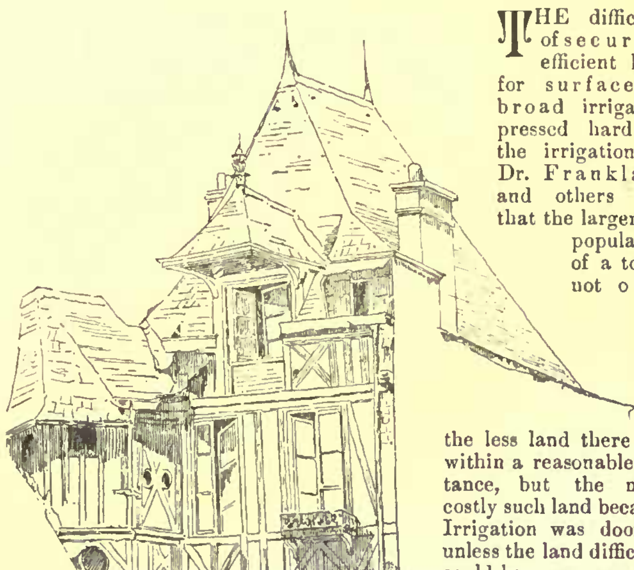
SKETCH OF THE TOWER OF THE 138TH STREET STATION, N. Y. C. & H. R. R. R., NEW YORK, N. Y. MR. R. H. ROBERTSON, ARCHITECT, NEW YORK, N. Y.

THE CATHEDRAL, SEVILLE, SPAIN, AFTER AN ETCHING BY DAVID LAW.

THE TREATMENT OF SEWAGE.[1] — IV.

II. — INTERMITTENT DOWNWARD FILTRATION.

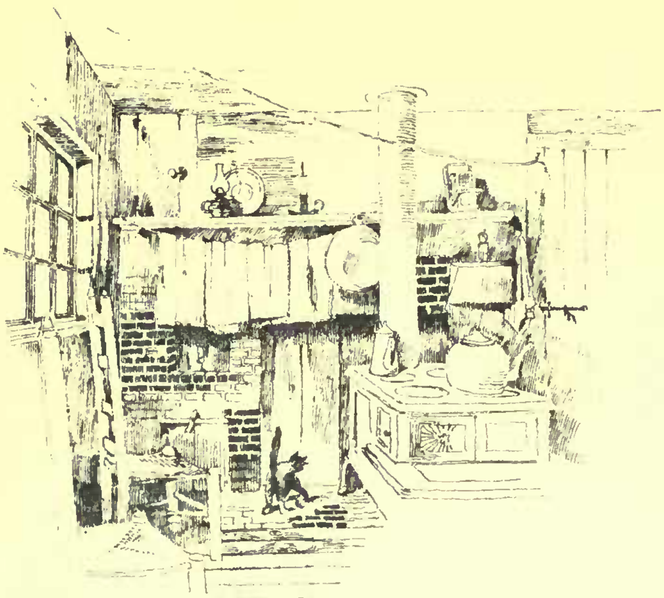
The difficulty of securing efficient land for surface or broad irrigation pressed hard on the irrigationists. Dr. Frankland and others saw that the larger the population of a town, not only the less land there was within a reasonable distance, but the more costly such land became. Irrigation was doomed unless the land difficulty could be overcome, and some method adopted whereby a large volume of sewage could be concentrated on a small area.



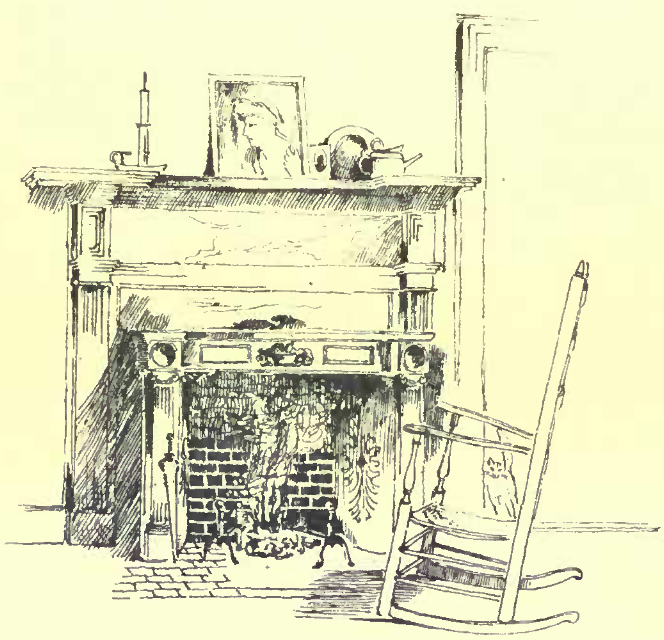
AT ROUEN, FRANCE. AFTER SKETCH BY H.G.KING

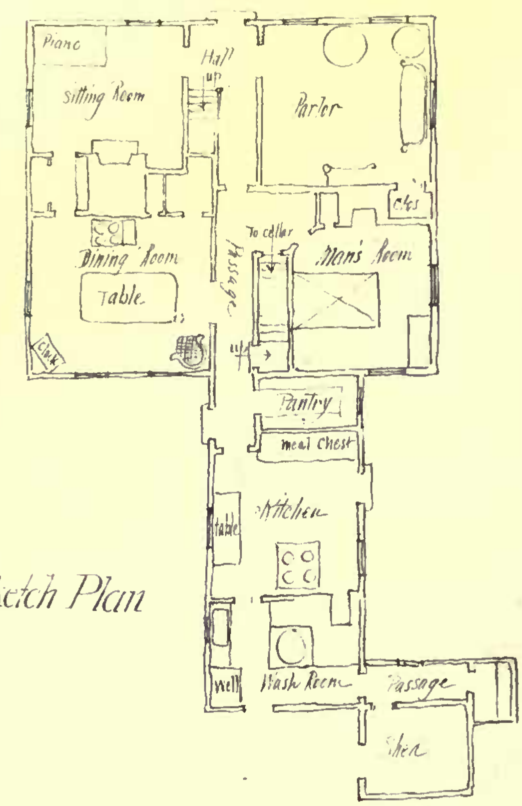
Dr. Frankland's laboratory experiments of 1870, with known quantities of different soils, gave birth to the process known as "Intermittent Downward Filtration." For this purpose it was stated to be necessary (1) to have a suitably constituted soil, which will act as a filter; that is, a soil not too open, so that anything may pass through, but not too close, so that nothing may pass through. (2) To have the land deeply drained, say at a depth of six feet, so as to allow a considerable distance for percolation. This constituted filtration as opposed to irrigation. The land becomes an oxidizing instrument, to burn the impurities, and so transform them into harmless gases, rather than a mere separating machine. To obtain the best effects of oxidation, and to keep the land in the most effective condition, the

[1] A paper by Dr. C. Meymott Tidy, read before the Society of Arts, April 14, 1886, and published in the *Journal* of the Society. Continued from No. 569, page 243.









Sketch Plan

SKETCHES
in a Farmhouse, Natick Mass

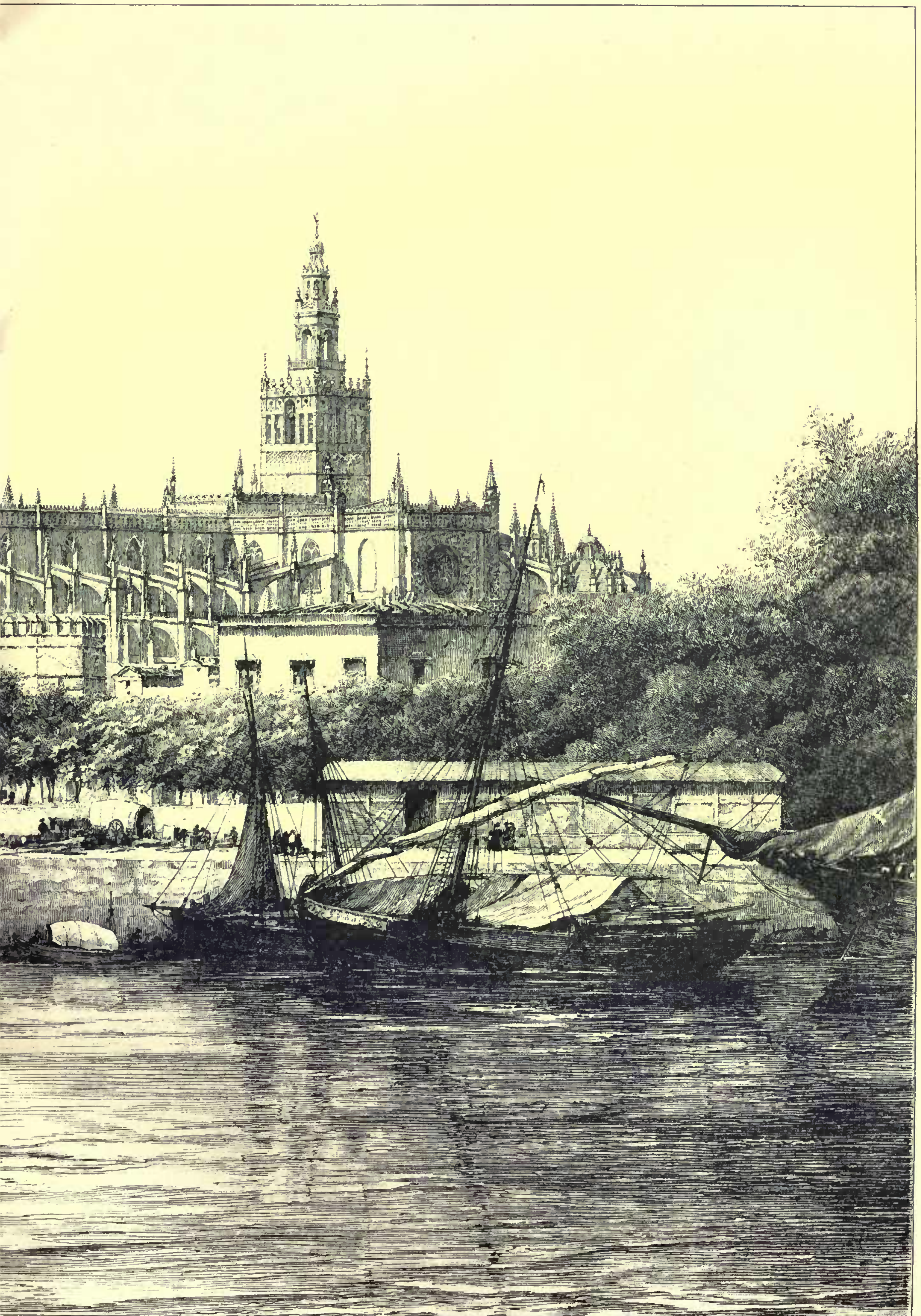
Henry Bacon Jr. Del.

Heliotype Printing Co Boston



ILDING NEWS, NOV. 27 1886.

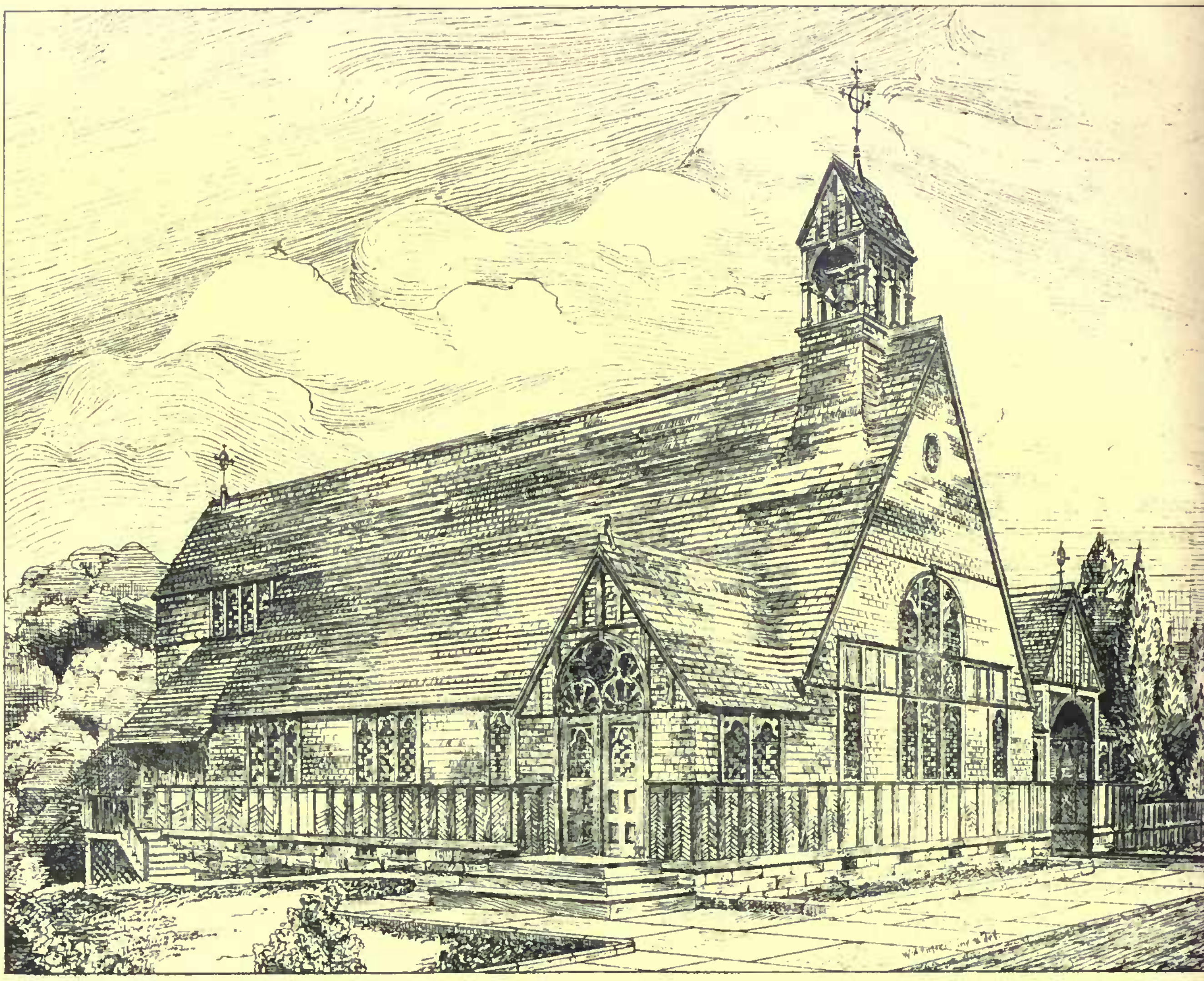
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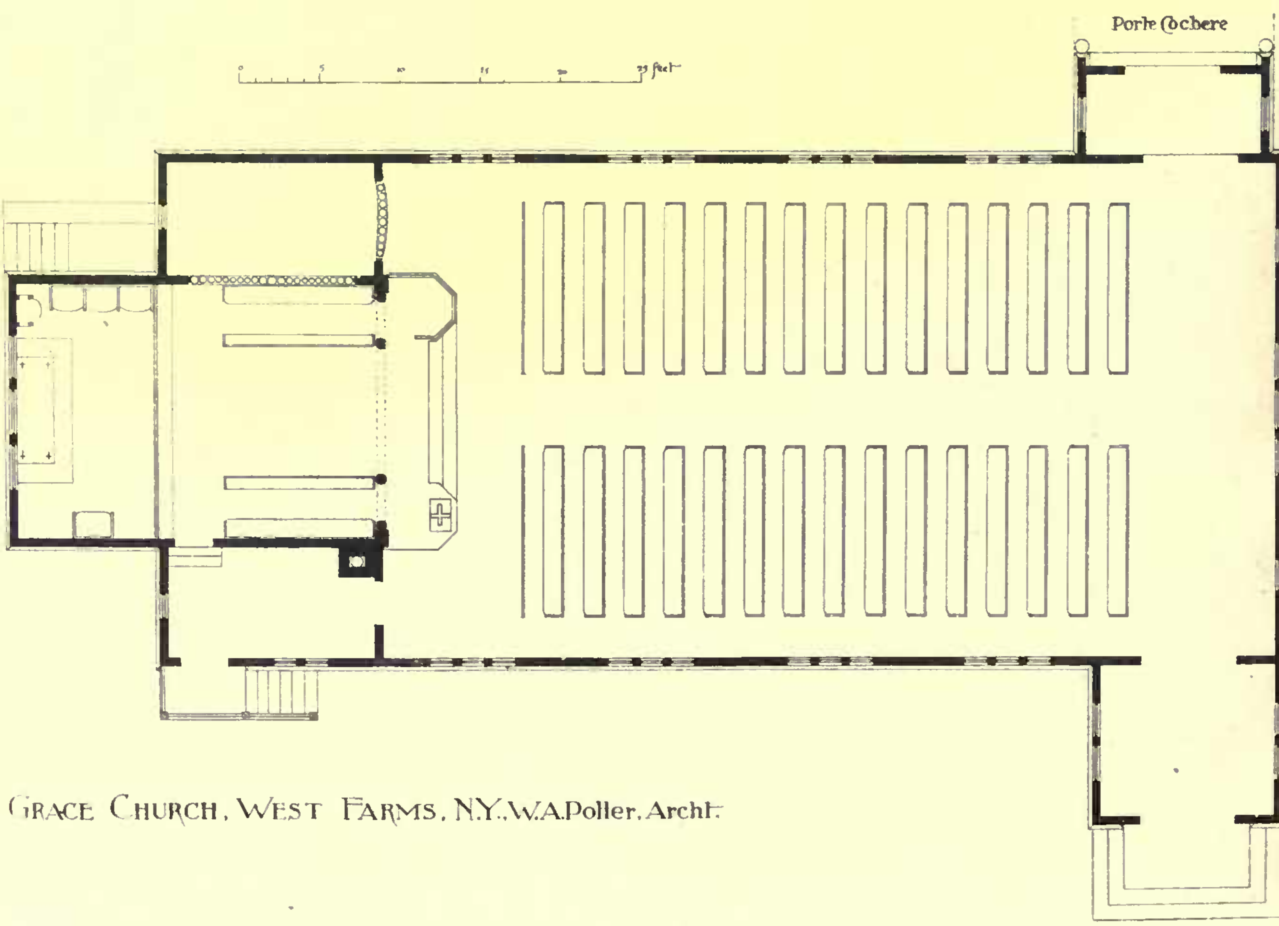


Heliotype Printing Co Boston

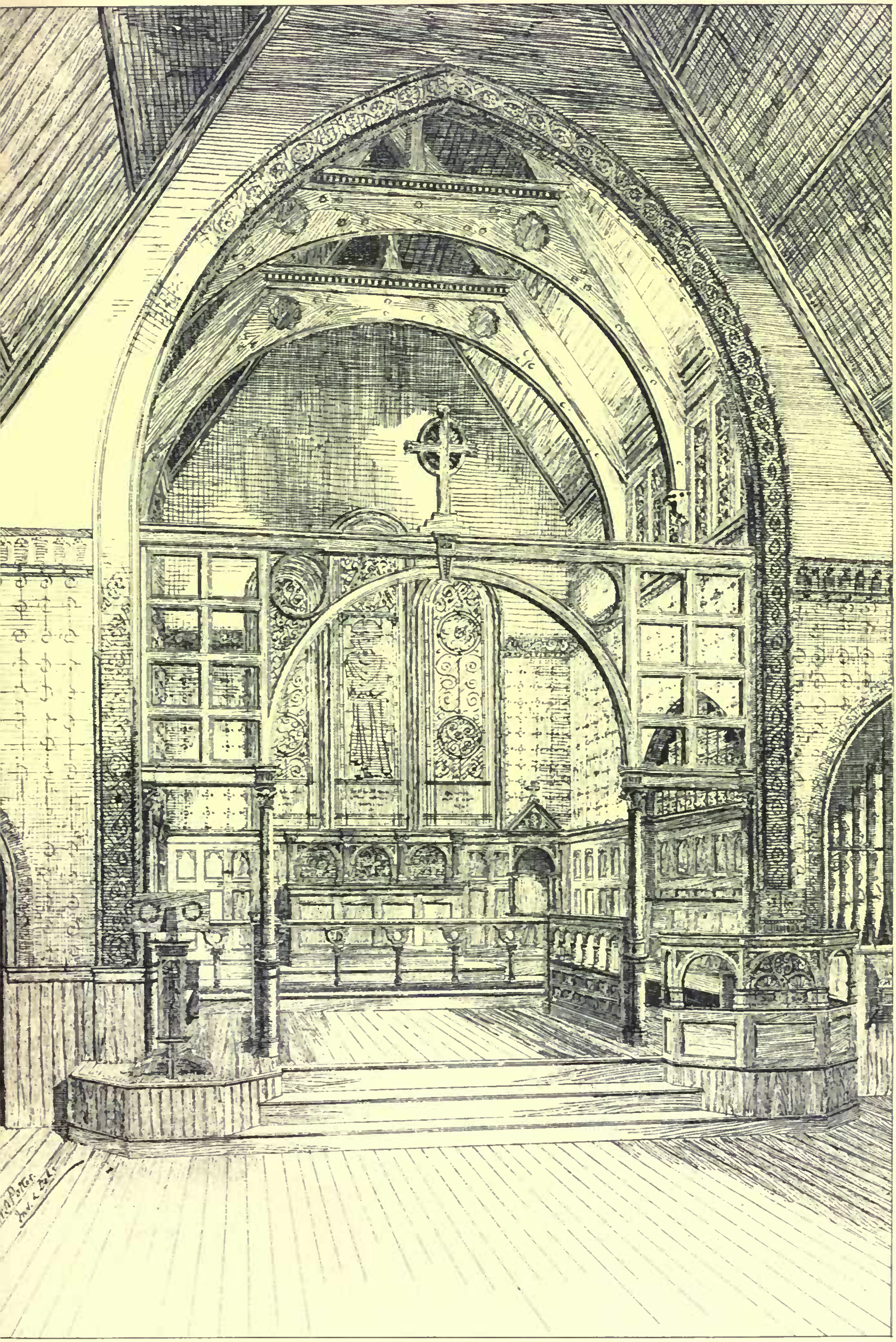
e.

David Law





GRACE CHURCH, WEST FARMS, N.Y. W.A.Potter, Archt.



Heliotype Printing Co. Boston

sewage must be applied intermittently, *i. e.*, with regulated intervals of rest, to give time for air to go into the ground as the water runs out, thus fitting it for a fresh dose of sewage. Intermittent filtration, Dr. Frankland would say, is a copy of nature in the lung action of respiration, alternately receiving and expelling air. This intermittent work avoids, he would contend, the clogging of the soil, and secures its efficient and frequent aëration. By such means Dr. Frankland stated that the sewage of 3,300 people could be treated on one acre of land.

Let me endeavor to give an illustration of the method of working the intermittent downward filtration system.

Suppose a population of 9,900, with three acres of suitable land suitably drained. Each acre, for purposes of work, is subdivided into four parts, the sewage of 3,300 being placed successively for a period of six hours on each quarter acre. Thus each quarter acre receives the sewage of 3,300 people for six hours, eighteen hours' rest being allowed before it receives another dose. Some have suggested, in further development of the idea of intermittency, that one of the three acres might be used per year for the 9,900, so that each acre would have two years during which it might the more perfectly recover itself, whilst each quarter-acre of the one acre in use for the year would have eighteen hours' rest out of the twenty-four. It is no misnomer to call this "intensified irrigation."

But Dr. Frankland's arguments were based on laboratory experiments. The varying effects of the varying qualities of sewage on the one hand, and the enormous differences in land, as regards its capability of absorption and filtration on the other, seem to have been very imperfectly considered. Nor were the difficulties arising from subsoil water taken into calculation, nor the density of the soil in the laboratory experiments, as compared with its density in the natural state. I am fully aware that Dr. Frankland would say that the estimate of 3,300 to an acre supposes proper land — properly drained, properly levelled.

It is right, too, we should note, that Dr. Frankland has from the first insisted that intermittent downward filtration involved the sacrifice of the manurial value of the sewage, the area of ground being too small, and the quantity of sewage too large, to make it pay. This view, however, Mr. Bailey Denton in no way endorses; on the contrary, he considers that the system of the intermittent application of sewage to land in no way interferes with, but actually assists, farming operations.

Both Dr. Frankland and Mr. Bailey Denton agree in considering the removal of the suspended matter in the sewage before its application to the land to be unnecessary. Mr. Bailey Denton, however, advocates the use of furrows (rather than flooding the land), partly as a means of preventing the clinging of solid sewage matter to the stalks and leaves of plants, and partly with the object of bringing the sewage into contact with the roots, which are the active abstracting agents of manurial worth. Indeed, Bailey Denton goes so far as to say that the presence of the suspended sludge in the sewage is an advantage rather than a bar to its application to land. By making some furrows of greater depth than others, he renders these the receptacles of the solid matters. The sludge, he says, "consists of vegetable and animal substances which are perishable, mixed with earthy and mineral substances which are not perishable." It is only necessary to remember this "to realize the fact that they cannot possibly clog the land when dry. The most minute particles consist of fine road sand which floats on in the liquid after the heavier detritus has deposited itself. When these perishable and imperishable substances find their way into the soil, they must each, from their nature, obviously add to its porosity, inasmuch as the perishable substances leave open spaces as they decay, whilst the imperishable substances, from their gritty nature, necessarily help to increase its filtering capabilities. So long as the sludge is wet it impedes absorption to a certain extent, but when once dried and the land broken up by the plough, it not only ceases to uphold the liquid, but naturally and permanently helps to let it into and through the soil." In other words, by digging the sludge into the soil, Mr. Denton contends that the soil is rendered more percolative than before. There may be something in this view. But how often have we seen, in practical working, sewage being applied to land, clogged by large masses of black albuminous matters, the result of previous irrigations, closely adhering to the soil, impeding absorption, and lessening the surface through which the water can pass into the ground. Mr. Denton says, "the sludge must then be allowed to dry, and when in a fit condition dug in." But in the act of drying comes the nuisance. In hot weather it means putrefaction (Mr. Denton calls it decomposition of perishable substances), and with putrefaction comes a stink, besides which it is in the act of evaporation that dangers occur from detrimental matters being carried bodily into the air. In filter-beds, we know full well that the surface of the filter-bed is that part most affected, and further that, for efficiency, the surface of the filter-bed needs frequent removal and cleansing, whilst irrigated land shows neither to the eye nor to chemical analysis much indication of any excess of organic impurity a few inches from the surface.

Let us take two cases by way of illustrating the practical working of intermittent downward filtration: —

The Merthyr Tydfil farm, with its 50 feet of gravel soil, may be taken as pattern ground for the system. Nothing, moreover, was spared to make it a success under the able advice of Mr. Bailey Denton. The mean depth gave two cubic yards of drained soil for every square yard of surface. The cost of preparation was very great. But how about number to the acre? Is not the actual number of persons per acre more nearly 1,000 (I think I am much overstating it) than 3,300? Is not the sewage of Merthyr very dilute by reason of its admixture with subsoil water?

At Kendal again, Mr. Denton, in 1873, advised the purchase of 16 acres of suitably constituted soil, upon which to treat the sewage of 13,500 persons, with a mean dry weather discharge of 975,000 gallons. The Council, with the Report of the Rivers Pollution Commissioners before them, deemed Mr. Denton's suggestion of 16 acres extravagant. If, said they, one acre will do for 3,300, why advise 16 acres for our 13,500, of which very few (probably not one-third) contribute sewage. The Council, however, decided to be liberal, and advised the purchase of 5½ acres of land. The cost of the Kendal sewage-farm was £16,371 (I quote from an official document); and the cost of laying out the filter-beds £1,400, *i. e.*, about £280 per acre. But can the Kendal effluent be deemed a success? Some 11 acres have been added since 1880. The Council have let the land, and I fear the process adopted can scarcely, at the present time, be regarded as intermittent,

I admit to the full the power of soil to purify sewage by oxidation. I admit, moreover, the advantage of intermittency of action, *i. e.*, of intervals of rest alternating with intervals of work. The entire success of the process, however, depends on perfect aëration during rest, to fit the soil for its next period of work. My experiments lead me to doubt the efficiency of a rest of eighteen hours only, even when the sewage has had the solids in suspension removed. But of this I am certain, that when the suspended solids have been allowed to remain in the sewage, the glutinous constituents of the sewage, together with the *papier maché* material in solution, clogs the ground with an impervious covering, whereby the entrance of air is very much retarded. Further, the sewage, when applied after the period of rest, cannot flow through the ground on the surface readily, on account of the glutinous layer and *papier maché* film. Thus, as a result, the period of rest fails to become, *quâ* the soil, a period of aëration. This condition will be aggravated should the effluent water, from any circumstance, not flow freely away. Thus the very conditions of success may be, and as I know often are, thwarted during the period of rest, as the result of the preceding period of work.

And here I will quote from an excellent paper by Dr. John M. H. Monro, read before the Society of Chemical Industry, and printed in their journal (January 29, 1885). He says: —

"There are several causes for this disappointing want of success [referring to broad irrigation], but the chief among them is the inability of arable soil to deal with a continuous supply of sewage without great deterioration in its purifying and aërating properties, so that at last it becomes 'sewage-sick,' and inefficient as a purifying agent. This is not completely remedied by intermittent filtration or irrigation, for the land which has been often covered with crude sewage never recovers, even by rest, its original efficacy. The commonly-accepted, and I believe the true explanation of this is, that the slimy suspended matter of the sewage gradually chokes the pores of the soil, forming a deposit impervious to air, and thus preventing the aëration to nitrification, and, on the other hand, encouraging putrefactive fermentation."

Difficulties of a practical nature crowd upon us in considering this method of treatment. Three, at any rate, may be noted: —

1. The cost of preparing the land for the work.
2. The difficulty of securing proper land, or of ensuring its effective working at all times, in all weathers, with all kinds of sewage, and under all circumstances.
3. The fact that much of the solid filth of the sewage will, unless previously removed, accumulate on the surface, where it undergoes decomposition and becomes, especially in hot weather, a formidable nuisance.

Intermittent downward filtration had its birthplace in the laboratory. Whether the earth used were cube feet or yards, or six-foot tubes, many details besides this mere statement of the work accomplished are necessary. Was the earth used surface earth? How was the sewage collected? Was the earth exposed to the modifying influence of wind, light and rain? How long was the earth used — a week, a month, a year, or longer? It is to be feared that a new birth in sewage treatment needs a less cramped cradle than a London laboratory. You cannot learn how to direct an army in the field by practising with toy soldiers. No laboratory experiment pure and simple can teach sewage treatment.

We now turn to the hygienic aspect of sewage irrigation. I shall speak of three classes of effects rendering sewage irrigation dangerous to the public health: —

1. Offensive and injurious emanations.
2. Pollution of subsoil water.
3. Distribution of undefæcated sewage containing the ova of entozoa.

I. OFFENSIVE AND INJURIOUS EMANATIONS.

Of such emanations, the evidence is ample. (Flower "*On Sewage Disposal*," p. 13, *re* Aldershot farm.) The River Pollution Commissioners (first report, p. 87) admit that odors do arise from land irrigated with sewage, day after day, for years. The Craigentinny meadows, near Edinburgh, can only be described as filthy, emitting a stink hardly endurable. The surgeon to the barrack adjoining the meadows, described the stench (1868) as "sickening." Of the

Croydon Sewage-Farm, at Beddington, Dr. Creasy, Surgeon to the Orphan Asylum at Beddington, stated that "typhoid fever had been in every cottage on the estate" — every disease, in fact, assuming a particular type, accompanied by what is called "a sewage tongue." In fact the stink of sewage-irrigated ground, and the malarious effects of the sewer gases evolved, are matters of frequent complaint and litigation. Dr. Clouston traced an outbreak in dysentery in the Cumberland and Westmoreland asylum (where there were 200 patients) to the effluvia from a sewage-farm (*Medical Times and Gazette*, June, 1865). The dysentery appeared soon after the sewage was used, 31 being attacked, of which 20 cases proved fatal. The farm was 300 yards from the female ward, where the greater number of cases occurred. The sewage-farm was removed, and the dysentery disappeared. The following year some land near the asylum was again irrigated, when another outbreak of the disease occurred. The facts show incontrovertibly that sewage emanations may be the cause of dysentery, diarrhœa and typhoid fever.

The investigations of Letheby into the cause of an outbreak of typhoid at Shaftesbury and the adjacent village of Enmore Green (1862), where one-eighth of the population were attacked in one year (viz., 448 cases in a population of 3,500), clearly point to the morbific effects produced by sewage emanations. We have the same authority pointing to a similar case at Copley village (which lies at the junction of the Hebble Brook and the River Calder) having a population of 1,000, where an outbreak of typhoid occurred from the irrigation of a plot of meadow land with the sewage of Halifax. Dr. Edlin traced, he considers, an outbreak of scarlet fever (twenty-three cases) at Haileybury College, near Hertford, to offensive emanations from a field saturated with sewage, the cases occurring in the dormitories nearest to the garden receiving the urine and slops of the establishment. (Flower "*On Sewage Disposal*," p. 10.) Such cases are numerous. I suppose few sanitary facts are so well established as that certain epidemic diseases may be propagated by the excremental pollution of air and water. To keep sewer-gas out of our houses was one of the many great lessons taught us by Murchison. The referees appointed, in 1856, to consider the main drainage of the metropolis, had sound reasons for expressing fear of irrigation on a large scale, lest it should occasion danger to the health of the inhabitants by the pollution of the air of the district — a view, it may be noted, entertained by Liebig, and expressed by him in his well-known letter to the Lord Mayor (1865). There is, too, a remarkable statement by Copland, that the effects of sewer-gases are never so bad as when emitted from sewage spread out upon the land. This statement is worthy of consideration. Solid matter is given off during evaporation. As the turpentine in lead paint is evaporating, solid lead carbonate is carried into the air, and produces lead poisoning amongst the inmates of the freshly painted house. This cannot result from any volatility of the lead, but merely from the mechanical dislodgement of lead particles during the evaporation of the volatile constituents of the paint. For when the smell has gone the danger has passed. The sanitarian recognizes the importance of defecating the excreta of the typhoid patient as soon as evacuated, and of removing it from the sick-room without delay. And why? To prevent the *materies morbi* being carried into the air during the evaporation of the liquid portion. It must, therefore, be an unscientific method to spread the sewage of a mixed population over the land, thereby increasing the area of evaporation. Mr. Hawkesley's words may be quoted here. They are the record of one whose unique experience is only rivalled by his acute powers of observation: — "Water irrigation carried on in warm weather is exceedingly unhealthy. I can speak positively to it from repeated observation in different places, that the odor, particularly at night and particularly upon still damp evenings in autumn, is very sickly indeed, and that in all these cases a great deal of disease prevails. The sewage forms a deposit on the surface of the ground, that deposit forms a cake of organic matter, and organic matter when it is in a damp state, as it usually is, gives off in warm weather a most odious stench." (Committee of House of Commons, 1870.)

I am aware that in many cases the sewage before application to the land is submitted to a rough process of filtration; but even in these cases it is no uncommon thing to see masses of partially dried fæcal matter, the remains of previous irrigation, lying about the farm, giving off a filthy stench, and ready to be washed into the nearest stream by the first heavy shower of rain. Such a condition seems peculiar to no soil. Aldershot, with its porous soil (although, strange to say, described by the Rivers Pollution Commissioners as "well managed,") Banbury, with its sandy clay, and Warwick, with its stiff clay, one and all testify to the truth of what I say.

There is yet another point to be considered. That a district saturated with moisture, and more particularly if along with the moisture there is an excess of organic matter (I am excluding specific morbid emanations) is unhealthy and malarious, the fens of Lincolnshire and the rice fields of China, not to speak of other places, supply abundant evidence. Buchanan, in a masterly research, has shown that phthisis is more prevalent where there is a wet atmosphere than where there is a dry one, whilst Pettenkofer, of Munich, regards fever and cholera as dependent on fluctuations in the level of ground-water charged with sewage. The case is serious. Saturate — be continually saturating a large area with sewage water, and as a consequence be continually raising the subsoil water, an increased humidity of atmosphere must result, and conditions favorable to malaria, fever and phthisis.

Dr. Sturge, in 1879, in a paper before the Institution of Surveyors, gave some important details respecting the Sewage of Paris (see also Society of Arts Conference, 1879, p. 151). Seventy per cent of the Parisian houses have cesspools, but even of the remaining 30 per cent, the solid excrement is not allowed to enter the sewers. Some analyses of Paris sewage were given (respecting which, however, I speak with caution) showing 56 grains of organic, and 123 grains of inorganic matter per gallon.

Of the total 60,000,000 gallons daily of Paris sewage, 10,000,000 are treated on 914 acres of land at Gennevilliers. This land has about five inches of alluvial soil resting on ten feet of sand and gravel. I omit all reference to the agricultural success or non-success of the Gennevilliers farm, but it must be noted that authorities consider that the value of building land in the neighborhood has decreased, and that the health of the inhabitants suffered from a rise in the level of the subsoil water. (Report of M. Lefèvre, President of the Société des Géomètres of France.) I quote Dr. Sturge's words (p. 153): — "Great complaints have been made that since the introduction of the irrigation, ague has become far more common than it was before, and more deaths occur from diarrhœa and dysentery."

One thing is abundantly evident, even to any untrained observer, viz., that it is impossible to insure a pure effluent by an irrigation process. The land which is covered with an active crop of vigorous vegetation, is a totally different purifying area from the same land upon which no rye grass or other vegetation is growing. The land under the influence of summer warmth and active evaporation is entirely different from what it is at times of frost or snow. The land flooded with heavy rains is different land from what it is in dry weather. Inequality of purification, uncertainty of action — at one time good, at another doubtful, at another absolutely useless — is the record I have to give from personal observation, and that on no limited scale, of irrigation as a method of purifying sewage. The sewage comes every day to be treated, and no earthly power can say whether your farm is or will be in a condition to deal with it. And more than this, the very condition that increases the quantity of the sewage to be dealt with (such as heavy rain) is the very condition that renders your land temporarily disabled. And yet further still, the very condition that increases the bulk of your sewage, or at any rate its polluting character — the population — is that condition which renders costly the land in the neighborhood, and probably makes it altogether impossible to procure at any price. I give, on the next page, certain analyses of sewage effluents from different farms.

II.—POLLUTION OF SUBSOIL WATER AND OF RUNNING STREAMS.

The select committee on the sewage of towns, although champions of irrigation, admit that if the power of the soil be overtaxed (that is if too much sewage be applied) there must of necessity be injury to wells and running streams.

III. — DISTRIBUTION OF UNDEFECATED SEWAGE CONTAINING THE OVA OF ENTOZOA.

The fact has always been recognized that entozoic diseases have an external origin — i. e., that the ova or parasites come from without, and are not generated within the human body. Millions of ova are voided with every segment discharged by the person afflicted with tapeworm, each ovum being capable of producing a measle in the flesh of an animal, and each measle a tapeworm in the body of the man.

Here, then, are two serious consequences of irrigation worth considering.

I have seen water-cresses and celery grown on sewage ground, having a quantity of dried sewage matter deposited on the stems. I have, with more than a cook's patience, tried to wash this matter off, but the tenacity with which it sticks upon the surface of the vegetable when once dry is perfectly astounding. Be it remembered that water-cresses and celery are eaten uncooked. I have seen cabbages and turnips, not merely grown on sewage ground, but carefully prepared arrangements made for a weekly flooding with sewage, the market produce being placed in a kind of reservoir permitting sufficient raw sewage to flow into it, so that it may completely cover the vegetation.

The grass covered with sewage, eaten as it is with rapidity by the cattle, infect their bodies with the larval parasite. Thus the meat is measly, and measly meat, except for efficient cooking, means tapeworm to the human subject. Perhaps a similar story might be told of trichina, with its ten times greater danger. No doubt, as an accident, the danger is constant, but sewage-irrigation would practically render it an affair of certainty. In other words, sewage always contains excremental ova. The farm, therefore, that receives sewage must be more liable to produce measly meat than the farm that does not receive it.

"May we not, indeed," says Dr. Cobbold, "but too reasonably conjecture that the wholesale distribution of tapeworm eggs, by the utilization of sewage on a stupendous scale, will tend to spread abroad a class of diseases some of which are severely formidable? So convinced am I of the truth embodied in an affirmative reply to this latter query, so certain am I that parasites are propagated in this particular way, so surely do I see unpleasant results if no steps are taken to counteract the evil, that I feel myself bound to speak out boldly, and to produce no uncertain sound in the matter, which

most closely concerns humanity. The whole question is, in truth, of vast hygienic importance."

ANALYSIS OF SAMPLES FROM SEWAGE-FARMS.

Constituents per gallon.	Matters in solution.					Matters in suspension.		
	Total solids.	Ammonia.	Oxygen required to oxidize the organic matter.	Nitrogen as nitrates.	Chloride of sodium.	Total solids.	Organic and loss on incineration.	Mineral.
ALDERSHOT FARM.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.
Raw sewage	53.93	7.54	4.38	0	14.92	43.77	29.75	14.02
Effluent	54.12	5.74	3.73	0	19.41	10.17	4.91	5.26
Blackwater stream before receiving effluent	18.93	0.18	0.35	0.26	4.12	2.68	0.69	1.99
Effluent after straining	53.73	7.54	4.40	0	15.36	35.01	26.24	8.77
BANBURY FARM.								
Raw sewage	48.87	3.81	1.42	0	8.94	3.27	1.86	1.41
Effluent	39.73	0.48	0.83	0.63	8.46	0.38	0.13	0.25
WARWICK FARM.								
Raw sewage	47.21	2.20	0.86	0	11.05	24.67	11.87	12.89
Effluent	52.63	0.32	0.48	0.10	9.12	0.26	0.13	0.13
RUGBY FARM.								
1 { Raw sewage	36.67	4.43	0.92	0	8.41	1.28	0.64	0.64
1 { Effluent	37.87	1.28	0.42	0.21	7.44	0.32	0.13	0.19
2 { Raw sewage	43.40	3.84	0.95	0.22	—	9.52	4.48	5.34
2 { Effluent	36.11	0.48	0.30	0.23	—	—	—	—
WORTHING FARM.								
Raw Sewage	30.33	0.23	0.32	0.33	—	4.38	0.87	3.51
Effluent	40.67	0.08	0.12	0.34	—	—	—	—
CARLISLE FARM.								
Raw sewage	30.17	1.92	0.78	0.03	—	3.62	2.17	1.45
Effluent	17.67	0.19	0.27	0.10	—	—	—	—
CROYDON FARM.								
(*a*) Beddington { Raw sewage	27.67	2.00	0.43	0	—	10.16	4.12	6.04
(*a*) Beddington { Effluent	27.17	0.12	0.24	0.35	—	0	0	0
(*b*) Norwood { Raw sewage	41.00	2.00	0.91	0.55	—	11.01	6.03	4.98
(*b*) Norwood { Effluent	58.19	0.32	0.82	0.60	—	1.98	0.18	0.80

Let us review our facts. We have dilute sewage to deal with. We desire to be sanitarians, viz., to purify our sewage so that it shall not pollute our water-courses or cause nuisance. We desire to be economists, viz., to get out of the sewage all that is valuable in it. In a word, we desire to achieve, by one and the same operation, a sanitary success and a commercial profit. In sewage treatment, as in other things, you cannot combine the impossible. Achieve your commercial success, and you must abandon sanitary considerations. You must, as at Edinburgh, flood your land with your thousands of tons of sewage per acre, until your farm is a stinking morass, and your effluent water so impure that you must take it directly into the sea lest you foul your water-courses. Achieve your sanitary success, sprinkle your 300 tons per acre per annum on your land with hose and jet, and away goes your agricultural profit. Try a compromise between the extremes of the 300 and 10,000, and you get the difficulties of both with the advantages of neither. I admit possible exceptions: a small population; cheap land removed from human habitation; a porous soil admitting free percolation; happy gradients not requiring steam-power; proximity to the sea, so that extreme purity of effluent need not be demanded; proximity to a town, so that a ready sale for the sewage grass for dairy purposes can be secured. But the difficulties are enormous. I must have enough land — and the greater the population with whose sewage I have to deal, the greater the quantity of land required, and the larger, probably, its price. I must have proper land — sufficiently porous, but not too porous, properly levelled and drained. If the level of my land be above the sewer outfall, I require costly motive power. The larger the quantity of sewage (as in wet weather) with which I have to deal, the less able is the already overloaded ground to cope with it. Frost or snow, the work has still to be done. At all times the effluent must be sufficiently pure, lest litigants be aroused. At all times the operations must be conducted without offensive smells from an over-sodden state of soil, and without polluting the air by rendering it abnormally damp or polluted by sewage effluvia, the prolific source of typhoid. The subsoil water must be so diverted that neighboring wells shall not be polluted. Grant all these difficulties overcome, and there remains as the produce of my farm a grass only fit for dairy purposes, and even then likely to be a source of entozoic infection to man and animals.

[To be continued.]

QUICK-LIME USED TO PREVENT THE STAINING OF LUMBER. — The lime treatment for preventing lumber in pile from staining promises to be of great value to lumber manufacturers and shippers. The theory is that the stain is the result of a fungous growth and that such growth is destroyed by the fumes of quick-lime. As stated in these columns last week, the Peninsular Lumber Company applied the lime by sprinkling it over the courses as the boards were piled. Others have found it efficacious to simply dump a barrel of lime under the four corners of the pile. A New York gentleman who called at this office within the past week, was enthusiastic over the experiment, and said that the next shipments of yellow pine he made from the South he should certainly throw a barrel or two of lime into either end of the vessel and watch carefully the results. If a little lime in a vessel would prevent yellow pine from sap-staining, he said it was one of the greatest discoveries of the age. — *Northwestern Lumberman.*

BIRMINGHAM COMPRESSED AIR-POWER SCHEME.



IN THE CLOISTER OF ST SAUVEUR, AIX. FROM REVOIL.

ENGINEERING gives the following abstract of the paper read by Mr. J. Sturgeon at the recent meeting of the British Association on the Birmingham Compressed Air-Power scheme, and the discussion which followed the reading:

This scheme, the leading features of which are no doubt familiar to the majority of our readers, is now attracting a good deal of attention in engineering circles, and the reading of a paper by the engineer of the company that is to work the system had been looked forward to with considerable interest. As we give in this issue a detailed description and illustrations of the proposed installation, we will confine ourselves to a brief abstract of the paper read, which will be sufficient to make the discussion which followed intelligible.

The author first pointed out the objects of the scheme, and showed that the large number of engines of moderate size used in Birmingham, often intermittently, renders some such system peculiarly applicable to the town. He then went on to say that although each 1000 horse-power at the central station may only produce 500 effective horse-power at the users' engines, it will displace fully 1000 horse-power of small boiler plant, furnaces, chimneys, etc., and the same engines can be used with compressed air as with steam. The centralization principle enables engines and boilers to be used of large power, with all the modern improvements, such as high-pressure triple-expansion, gas firing, etc. At the pressure proposed (45 lb.) the air-driven engines will indicate from 30 to 65 per cent of the power developed at the main engines, according to the mode of using the compressed air. The investigations of Sir F. Bramwell and Mr. Piercy, on behalf of the Birmingham Corporation, showed that the present consumption of fuel in small engines of from 4 to 25 horse-power varies from 36 pounds to 8½ pounds per horse-power per hour, and, as it is estimated that compressed air-power would reach the consumer at an expenditure of from 5 pounds to 2.3 pounds fuel per horse-power per hour, a saving of from 700 to 400 per cent is effected.

The works will be situated on land fronting Garrison Lane. The first portion is laid out for the erection of 15 engines of 1000 horse-power each, to be worked by Lane's patent boiler and Wilson's gas-producers. As the company have already received applications for over 3,300 horse-power, they have entered into contracts for the completion of 6,000 horse-power at the central station before May 31, 1887. The mains will all be of wrought-iron, laid in concrete troughs near the surface of the road, so that they can be easily got at for examination and repairs. They will vary in size from 24 inches down to 7 inches. Valves will be provided, by which, in case of damage to any portion of main, that portion will be automatically stopped off from the rest of the district, so as not to interrupt the general surface. The compressed air will be sold to users at a price per 1000 cubic feet of air at a standard pressure of 55 pounds, measured by a metre so constructed as to register the volume delivered at the value of the standard pressure, independently of any variations there may be in the main pressure. The meter consumption of the various users will be registered in the gross on a dial at the central works by electric apparatus, so that any waste or misuse of the air can be at once discovered and prevented.

The paper concludes with a discussion of the various economical aspects of the question, pointing out that compressed air can be used for all purposes for which steam is employed, except heating; air, on the other hand, has the advantage over steam that it is available for refrigeration.

The discussion was opened by Mr. H. Davy. The author had quoted a statement of his that in the application of water for craneage of goods, an efficiency of not above 25 per cent was obtained. This was but a partial statement, and he, the speaker, would say that the general efficiency of hydraulic power was much higher, probably 50 per cent. He had had a good deal of experience with compressed air for mining purposes, and would give, as the result of his observations, an efficiency of from 25 to 30 per cent for a pressure of 45 pounds above atmosphere. In a table exhibited on the walls the author had set down the efficiency at 84 per cent, and he was at a loss to see how this could be realized. The speaker then went on to criticise other figures in connection with the scheme, but he appeared to have misconstrued the bearing of the calculations, and the author interposed to give the necessary explanation. The same mistake was afterwards made by other speakers, and indeed the table shown was somewhat misleading when read by itself, although quite straightforward when taken with the text in the paper referring to it. Mr. Davy also criticised the engine condenser, a drawing of which is shown. It appeared to combine the features of both a surface and jet condenser. He would like to hear what advantage was gained by this arrangement. Professor R. Smith, in speaking of the consumption of fuel in small engines, which had been put down by the author as high as 36 pound, an amount which

had been thought too high by a previous speaker, said that, in intermittent work, he could easily understand such a fuel consumption would be reached. He knew of many small engines, constantly working, which required 12 to 13 pounds of coal for each indicated horse-power developed, and if they had to stand for frequent periods of time with steam "up" in the boilers, he should anticipate such a fuel consumption as that named by the author would be reached. This argument was in favor, not only of general distribution of power by air, but by gas, through the means of gas-engines, and by electricity also. Birmingham was an especially favorable field in which to try an experiment of the nature proposed by Mr. Sturgeon and those working with him, because of the large number of small workshops requiring a little power, and that often of an intermittent nature. The efficiency of air transmission decreases less than with most other agencies with distance. In hydraulic pipes there is the friction; in electricity there is the heating of wires, but the loss in the case of air is very small. Professor Smith has met with cases in collieries in which power generated on the surface had been taken to accumulators below at a distance of one mile and a half, and there had actually been greater pressure registered at the accumulators than at the compressors. This, of course, was to be accounted for by the effect of barometical pressure, and the difference, though of small practical importance, served to show how slight was the effect of viscosity and friction in air. The speaker thought that for small distances and limited applications air would not pay, and gave, as an instance, the practice in the Aberdeen granite quarries, visited last year by the members of the Association. He had been surprised to find air was not used as a vehicle for distributing power in the various machines, but the owner said that steam was found to be cheaper. The distances there were from 300 to 500 yards, and the loss for condensation would therefore be small, and would be more than counterbalanced by the advantage of not having to introduce another machine, such as the air-compressor, with the loss that was always attended on the use of such mechanism. For long distances, however, he had no doubt air was the best vehicle for conveying power; still he did not agree with Mr. Sturgeon's calculation as to 33 per cent of the original power being obtained at the air-engines. The largest item of loss was the heating of the air in compression and cooling in storing and conveyance in pipes. In summer there would be the advantage of using the exhaust from the engines for ventilation. The difficulty of getting rid of frost round the exhaust outlets had been referred to, but this could be got over by making them trumpet-shaped.

Mr. A. Rigg said that the use of steam for power distribution in New York had been mentioned, and the failure of the system has been referred to. Two companies had been started for the purpose. One had laid cast-iron pipes and the other wrought-iron pipes. The result had been that the cast-iron pipes were constantly bursting and blowing up the pavement, and the company had subsequently "burst up" too. The wrought-iron pipes were, however, all right, and the company that laid them was going on. The loss of pressure from end to end of the system was only about 2 pound, or practically nothing. As to efficiency, anything could be got on paper, and he would wait for practical results.

Mr. Wright mentioned an interesting historical fact in connection with the use of air-pressure as a means of conveying power. In the year 1804, at the works of Boulton & Watt, William Murdoch had worked a lathe by a blast from a blowing-engine, the motor being 400 yards away from the source of power. Professor Unwin pointed out that in course of practice the experience gained would enable many percentages of loss to be reduced. Professor Hele Shaw criticised the author's design of meter, objecting to the application of the bent tube as in the Bourdon gauge; but the limited time at the disposal of the meeting compelled the president to ask the speaker to close his remarks, and Mr. Sturgeon was then asked to reply to the discussion.

In reply to Mr. Davy's remarks, he said that before he went into this question he was of much the same opinion as that held by Mr. Davy as to 25 per cent being the average efficiency of engine-power in working with compressed air in collieries. In a colliery, however, the air-compressor itself worked intermittently, for there was seldom enough work to keep it going. In the supply system for a large town, such as that then before the meeting, the conditions would be entirely altered, and the law of averages would give them practically constant work. In addition to this there would be the greatly increased size and more finished machinery in their case to set against the rough colliery appliances. The loss of leakage as shown by the experience at St. Gothard was practically nothing. Allusion had been made to the efficiency of the air in the St. Gothard Tunnel, but there, too, the same conditions did not exist, as the St. Gothard compressors had only to work one set of machines, and the question of intermittent work again arose. In the course of the discussion the theoretical loss by heating in compression and subsequent cooling had been dwelt upon. He wished to remind his audience, however, that there would be certain conditions in the practical work they proposed which would upset these theoretical deductions. They would cool the air during compression, and in many cases it would be reheated during expansion by means of waste heat from flues, etc., on the users' work. He thought that if the whole of the conditions were taken into account, instead of isolated facts without the concurrent conditions bearing on them, as had been done by some speakers, that it would be found that his figures accorded pretty closely with those of many of his critics. With regard to the 84 per cent efficiency, for instance, which had been so freely questioned, there was a loss of 12 per cent in main engine and compressor, friction in valves, etc. For leakage in mains and friction, wire-drawing, etc., at consumers' engines another loss of 13 per cent was set down. They would regain 20 per cent by reheating the air to 320°. This would give 95 per cent, but against this there was to be set the loss for clearance and back pressure in users' engines, which would give a total efficiency of 84 per cent.

Sir James Douglas, in summoning up the discussion, referred to the satisfactory working of compressed air that had come within his experience, and thought that the author had made out a very good case which had not been shaken by the discussion.

Mr. Preece added that in the Post Office air was more used as a means of conveying power than electricity, and he should be glad at any time to put his experience at Mr. Sturgeon's disposal.

COMMUNICATIONS

MILL FLOORS IN BOSTON.

To the Editors of the American Architect: —

Dear Sirs,— Mr. Atkinson's letter about mill floors in Boston ought to open a very useful discussion, which I would like to begin by noting a few points that occur to me.

Mr. Atkinson, in describing a building forty feet wide, as built on the slow-burning principle by the Boston architects, objects to the spacing of the posts so far apart as twelve feet; to the heavy longitudinal girder, which, as he says, is exposed to fire, catches dust and interferes with light; and to the spacing of the floor timbers only five feet apart, which interferes with the best arrangement of sprinklers.

In regard to the first criticism, about the excessive distance between the posts, I think all architects will agree with me that owners on account of the inconvenience caused by columns to many kinds of business, are rarely willing to set these nearer together than the maximum distance allowed by law, which in Boston is twelve feet. In the older stores, built before this regulation was made, the columns are often fifteen or sixteen feet apart.

As to the girder, the law here again interferes, and requires in Boston as in New York, that every store or warehouse more than thirty feet in width shall have either brick walls, *or girders supported by posts*, running from front to rear, and dividing the building into spaces not exceeding twenty-five feet in width, this being for the purpose of tying the front and rear walls together.

The spacing of the cross timbers is a matter partly of strength, and partly of economy. As most people suppose that placing the timbers five feet from centres answers every purpose of slow-burning construction, and as wider spacing would require the addition of an inch or more to the thickness of the planking over the beams, without diminishing the amount of timber to be used in the beams themselves, they naturally frame in this way; but Mr. Atkinson's point about automatic sprinklers, which is probably new to most of us, should, and undoubtedly will be in future, considered as far as possible. In many cases, however, the wider spacing would be impracticable, on account of the expense which would be involved in supporting in that way the weights with which we have to deal. Mr. Atkinson gives us four floors, the strongest of which, employing 8″ x 16″ hard-pine beams, ten feet on centres, and twenty feet long, will carry safely 106.69 pounds per square foot of floor. Now, 8″ x 16″ beams of hard-pine are expensive and difficult to get when wanted, and at 107 pounds to the square foot, even with the comparatively short clear span of nineteen feet, the floor would not be half strong enough for a building intended for general store or warehouse purposes. The New York Building Bureau used to publish a list of the loads per square foot of floor, independent of the weight of the floor itself, which must be provided for in various classes of warehouses. I have not the table by me at the moment, but the average load for dry-goods stores was taken at 200 to 250 pounds per square foot, and the standard for other kinds of business varied from this to 500 pounds or more. According to my experience, these estimates of weight which were probably made from actual measurement in stores of the kind referred to, were quite low enough. Not long ago I had occasion to determine the load to be provided for in the stock floor of a store in which the goods sold consisted entirely of bottles of ink and mucilage packed in boxes with sawdust. These would seem light goods compared with glass or metals, yet the weight of the boxes on the floor of the warehouse in which the measurements were taken, as left by the porter who piled them up, was 510 pounds per square foot, over a considerable part of the floor. Of course, the vacant aisles between the piles of boxes reduced the average, but even allowing for these, I did not feel justified in calculating my new floor for less than 350 pounds load per square foot.

In another case, where the building was leased to various tenants for storage, I found, a few days ago, 190 pounds of load per square foot, including the aisles, and the cases were so concentrated over the middle of the beams that I was obliged to calculate the load as equivalent, in its strain upon them, to an average of 210 pounds. Still another floor, measured about the same time, had an average load, including aisles, of 267 pounds to the square foot. Of course,

a loft for storing furs, or hats in boxes, is safe with a strength of 106 pounds per square foot, but the same loft may be let, when the hatter's lease expires, to a hardware merchant, so that the Boston law does wisely in fixing the minimum load, exclusive of the weight of the materials, which a store or warehouse floor shall be capable of bearing safely, at 250 pounds per square foot, and it would do still more wisely if this could be modified by prescribing greater resistances for floors intended to carry flour, metals, glass, or other heavy goods.

With such weights to provide for, and columns to be spaced as far apart as possible, girders, either of iron or wood, are useful, even if the law did not require them for other reasons. That they might, and should be, if possible, raised to the level of the floor timbers is certainly true, for avoiding, in the case of wooden girders, excessive effects from shrinkage, if nothing else, but this is usually supposed to involve either stirrup-irons for hanging the cross-beams, or weakening the girder by mortising. It need not necessarily involve either of these, as a two-by-four piece may be bolted or hung with irons, on each side of the girder, and the cross timbers notched upon this, but such a device would lessen the security against fire, and is not always to be recommended.

In regard to the objectionable practice of resting timbers directly on top of wooden posts, without an iron cap between. Mr. Atkinson's note is very timely, and will not be forgotten by those architects who like to get definite facts in aid of the rules they have learned. Very truly yours, C.

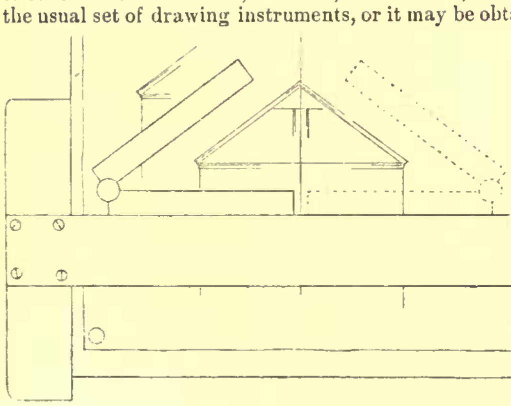
THE ISOGRAPH.

BOSTON, MASS., October 27, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,— For several years I have used a simple instrument in architectural drawing, the great convenience of which seems to be unknown to draughtsmen generally; at least I have seldom found any who had learned its value.

In England the instrument is better known, and is called an isograph, but I do not find it here at dealers in artists' materials. An excellent substitute for it, however, is the sector, which is often one of the usual set of drawing instruments, or it may be obtained separately.



The accompanying cut shows it in use as recommended. Its value lies in its convenience in drawing, where opposite equal angles are required, as in gables, roof-sections, etc.

The usual slower method of laying off with dividers is dispensed with, for when one side is drawn to the centre line, by simply turning the instrument over the opposite side is given with absolute accuracy.

DRAUGHTSMAN.

THE R. I. B. A. TRAVELLING CARD.

November 18, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,— The British Institute of Architects have prepared a card intended to facilitate the access of members to notable buildings for the purpose of sketching or examination. The card requests "all those whom it may concern to allow Mr. —, whose signature is on the card, and who is travelling for the purpose of architectural study, to sketch, measure, or otherwise examine any ancient or notable buildings or monuments under their charge, and to afford him such reasonable facilities and assistance as may lie in their power." The card is stamped with the seal of the Institute, and on the back is a translation into French, German, Italian and Spanish. From personal experience I know of how great value such a card would be in the saving of time, trouble and annoyance, abroad, and how many doors it would open which, without such a passport, even a silver key would fail to unlock.

I do not think such a voucher, issued by the American Institute of Architects, would be of much value, for most of the custodians whom it would be desirable to impress are convinced that America is largely peopled by Indians, except, perhaps, a few bankers and miners, who pass their time principally abroad.

Why could not our Institute, perhaps at its convention and through its secretary of foreign correspondence, secure the coöperation of the British Institute, to the end that the latter should issue their very useful cards to such Fellows or Associates of the American Institute as come to them properly-vouched for by our trustees. It would be a very graceful act on their part, and one which would be much appreciated, I doubt not, by hundreds of American students and architects who go abroad every year. If such a passport is valuable to a young student, it is doubly so to a busy architect, who steals away for a few weeks, and who desires to do all the sight-seeing available upon the route he has chosen with little loss of time and a minimum of friction. When time is no object it is no serious matter to hunt up a burgomaster or a *maire*, and, after an explanation and a good deal of box-wood sawdust, to obtain a pass to some church or collection; but when an architect's itinerary covers, as it always does, a great deal of ground in a very few days, such an aid would conduce much to his comfort. W. G. PRESTON.

NOTES AND CLIPPINGS

CLOCK-MAKING IN THE BLACK FOREST.— Consul Ballow, of Kehl, Germany, has been looking up the curious subject of the clock industry of the Black Forest. The "cuckoo clocks" of that region, he finds, are widely sold through all the civilized world. This country imports them to the extent of $50,000 a year. In the Black Forest there are 92 communities engaged in this industry, with 1,426 independent clock-makers, giving employment to 7,526 operatives. In 1796 these workshops turned out 75,000 clocks; in 1808, 200,000, and in 1880 the total production was 1,800,000 clocks. In the city of Furtwangen were manufactured over 400,000 of these. It would appear that this crop of timepieces is more remarkable for quantity than quality, for Consul Ballow writes: "One cannot be too particular when purchasing one of these clocks, for when the cuckoo will not coo any more, and the trumpeter will not blow another blast, then is their value as curiosities gone, and when, after a few months, they become valueless as time-keepers, then are they very poor stock indeed. I have heard so many complaints from people who have purchased these clocks in regard to their general poor quality that I deem it my duty to make this fact public, and also to inform would-be purchasers that, if they wish to avoid disappointment, they should be very particular where and of whom they purchase, and in no case to purchase of irresponsible parties."— *N. Y. Commercial Advertiser.*

ACTION OF WATER ON METAL PIPES.— From the Excerpt Minutes of the *Proceedings* of the British Institution of Civil Engineers we take the following article on the action of water upon metal pipes:

Widely-different opinions have been published on these subjects by experts, and even the official regulations with reference to the employment of various kinds of water-pipes are greatly at variance. Thus, in Germany, Switzerland, and in other places, galvanized-iron piping is used without hesitation, while by Government decree the use of pipes of this kind is forbidden in Austria, and in one instance their employment in Saxony was objected to. Some recent investigations of Mr. Lory, of Grenoble, have shown that water containing organic matter in solution attacks iron pipes very speedily, and after many analyses of water conveyed to Grenoble from different sources of iron pipes, and also of water known to have attacked pipes and led to the formation of scabs or carbuncles of oxide of iron in other places, Mr. Lory had invariably found that the scabs — consisting mainly of hydrated oxide of iron — contained from 5 to 10 per cent of organic matter. He has been led, therefore, to conclude that the destructive action upon such pipes is due, in the first instance, to substances of organic origin. This may, to some extent, explain the reason why in some places cast-iron pipes remain quite free from corrosion, whereas, in other cases, even after six months, as happened to Grenoble, they became covered with rust carbuncles. The influence of soft water on lead pipes is considered in the light of a recent report of Dr. White, Medical Officer of Health of Sheffield, and some experiments conducted last year at the Hygienic Institute of Pesth, are quoted, in which the water passing through a pipe 39 m. in length was found to contain from 0.085 to 4 7 mg. per litre of lead; the latter high percentage only occurred, it is true, after the water had remained in contact with the lead for a month. In view of the destructive action of some kinds of water on cast-iron pipes, information is sought concerning the protection afforded by covering the pipes internally with a coating of magnetic oxide, and the results of any experiments bearing upon this question.— *The Metal Worker.*

WHAT THE ELECTRIC LIGHT COSTS IN PHILADELPHIA.— "Philadelphia obtains electric lights cheaper than any other large city in the country," said Chief Walker of the Electrical Department, yesterday, in speaking of the apparent increase of 400 per cent in the appropriations to his department during the last three years. "The average cost is less than 55 cents per night a lamp, and the truth is most of the companies that do lighting for the city lose money by it. Many of them make their figures very low for the privilege of being allowed to place their wires upon the city poles, and cover their loss in the charges to private customers. There are 352 lights paid for by the city, and they cost $10,000 less than they would in other cities. As to the expenses of the department, the increase since 1884 is more apparent than real, and what there has been is for improvements rather than maintenance. The appropriation for 1884, when we did not have charge of the electric lighting, was $35,000, and in 1885, when it was transferred to us from the Police Department, the appropriation was $84,467. Although I asked for $178,114 for 1887, I do not suppose I will get that much. This year we had $104,995. Of this $70,664 is for the maintenance of lights already up, and I have asked for $25,000 for new lights next year. The odd $70,000 is divided among a number of companies whose prices for lamps vary. Thus the Brush Company receives 52 cents a night for its lamps on Chestnut Street, 58½ cents for those on Poplar Street, and 55 cents for those on Lancaster Avenue. The United States Company is paid 48 cents a night for its lamps on North Broad Street, 59¼ for those on Deleware Avenue, and 62 cents for those on Federal Street. The Northern Electric Light Company obtains only 39½ cents

for four lights on Second Street, above Callowhill, as the wires are strung on city property. It is paid 48 cents for its lamps on Girard Avenue. A company in Frankford, whose lights only burn half the night is paid 30 cents a lamp. In Germantown the price is 55 cents. The Thompson-Houston Company, whose lights are on Columbia Avenue, is paid 48 cents a night. The average price for all the lamps is, as I said, less than 55 cents a night apiece. The cost of an electric light depends upon the number of lamps on a wire, the distance from source of supply, and other considerations. It is because of the greater distance that the United States Company charges 62 cents for a lamp on Federal Street, while for those on Broad Street it asks only 48 cents. The distribution of the lamps is, of course, a matter resting entirely with the City Councils. It is only my duty to put them up where they are ordered. The operating expenses of the electrical department have increased very little, not over $4,000 since 1884, notwithstanding the great amount of extra work we have had to perform. The number of fire-alarm boxes has increased from 150 to about 500 within that time; the fitting up of the police-patrol service has been put upon us; telephones have been placed in all the fire-engine houses and hospitals, and many improvements have been made. Certainly, the expenses of the electrical department cannot be complained of as extravagant." — *Philadelphia Record.*

Trees Unfelled are Real Estate. — There was an amusing case tried here the other day. Some smart fellows from up North were perusing around for timber and happened upon an old, unsophisticated farmer and bought from him forty walnut trees for $5 apiece as they stood. They paid the money and took a bill of sale, and the old man felt rich. When the old woman came home he told her what a bonanza he had struck. She was surprised, but was not satisfied, and said it was a Yankee trick. In a few days another feller came along and offered $10 a tree, and she made the old man sign, and she signed, too. The money was tendered back to the first purchaser, but he refused to take it and sued for the timber. The court held that trees not cut down were part of the realty, and realty could not be sold without the wife's signature; so the sharpers lost their timber and their money, too. — *The Atlanta Constitution.*

M. Maspero's Egyptian Discoveries. — Among all the countries in which archæological explorations are going on, Egypt, which is the oldest, remains the most interesting. M. Maspéro presented last summer to the Academy of Inscriptions a report of his operations for the previous nine months. He has made a wise change in giving up the monopoly of antiquities which the Bulak Museum had, offering to share all that are found with the finder. The result is that now he is informed when a discovery is made, and finds the tombs unpillaged. He has, as it were, made the poachers gamekeepers. One such undisturbed tomb, besides the owner, his wife, and a large family, contained all the implements of his trade, and, best of all, the first part of the romance of "Sinuhit," a work of the seventeenth or eighteenth dynasty, of which only the second had been previously known. These romances, it is supposed, were put into tombs to amuse the leisure of the dead; the "Book of the Dead" has one chapter designed to teach the dead to play chess in the other world. The correctness of the portrait-statues of the Egyptian monarchs have received a striking confirmation. M. Maspéro presented to the Academy photographs of mummies of various kings that have been unrolled at the Bank Museum, and stated that the face of Seti I (an account of whose tomb, by the way, with over a hundred plates, has just been published as the ninth volume of the *Annales du Musée Guimet*), which is perfectly preserved, shows a wonderful resemblance to contemporary portraits of him that have been found on monuments. Such confirmation was not needed. The features of the Egyptian kings are so individual and full of character that one could not suppose they were fancy sketches. It is curious to hold an inquest on a corpse forty centuries old. Coroner Maspéro determines, on examination of the body of Ra-skenen, that he died fighting. There are three wounds, one that knocked him over and two others that finished him, and traces of decomposition show that some time was lost in bringing him from the field of battle. Another case is not quite so clear. A man twenty-five or thirty years old was left in most unusual style, without any inscription. Moreover, he was embalmed as usual; the internal organs were not removed, but the exterior was covered with some matter at once fat and caustic. The body shows that the man died in horrible suffering, and the question arises, was he poisoned or was he embalmed alive? Here is a hint of a palace tragedy on which some antiquarian novelist may write a novel more sensational than anything that Ebers has yet given us. — *N. Y. Evening Post.*

TRADE SURVEYS

The most encouraging and reliable factor in the general trade and industrial situation is the activity in real estate in large and small cities, towns, and even villages. Real estate agents and brokers are doing an unusually prosperous business in all sections of the country from which it is possible to obtain late reports. The best part of the reports is that prices are not exorbitant, that real estate for the most part is selling near actual value. Brokers in several cities have instructions to purchase sites for manufacturing and building purposes, which are intended to employ a large amount of capital. The New England States are no exception. In many of our textile, shoe-making and machinery-making centres builders are preparing to execute instructions recently received for the expansion of mill and shop capacity, and for the building of small houses for operatives. Manufacturers are interesting themselves in house-construction in many places, partly as an investment and partly to offer some inducement to their employés to make a permanent abiding-place for themselves. Despite the fact that the building-season is almost over, a great deal of new work has recently been projected on this side of the Hudson River. The reason has heretofore been referred to, namely, that the increased manufacturing activity and the better rate of wages has stimulated investors, builders, and wage-workers. A leading New England building authority says that much more building will be done this winter than last, and that a remarkable increase will be made in the steam-power and machinery-power of all mechanical establishments. In the vicinity of New York several estates have been cut up and sold in building lots. An outward movement is in progress from the centre of the city. The business requirements are driving residences out, and a leading architect there says that more fine houses will be built along the Hudson and in outlying towns in New Jersey next year that last. Important municipal enterprises are attracting the attention of the Philadelphia Councils. The projectors of an elevated railroad in that city have renewed their attack upon the conservative Councils of that city. The projectors of an underground system predict success to their request for permission to build thirteen miles of underground road. A syndicate which has been endeavoring to purchase or lease the gas-works have been disappointed in their efforts because of an opposition of public sentiment which is being industriously worked up in opposition to the scheme, which embodies the handing over of a plant which cost in the neighborhood of $25,000,000. Another syndicate is industriously at work seeking to obtain permission to expend thirty or thirty-five million dollars in the construction of a water-supply system which will guarantee 200,000,000 gallons of pure water daily. The building operations of that city will exceed last year's by twenty per cent. The iron and steel industries of Pennsylvania and the entire country continue very active. Shipments have been made this month from foreign ports of between fifty and sixty thousand tons of steel blooms to make rails for spring railroads because of the inability of the American Bessemer mills to supply the extraordinary demand. It is probable that the urgent railway requirements will necessitate the importation of enormous quantities of foreign material. New York brokers this week have instructions to negotiate for extensive supplies for delivery in January. The same general features are observable in all branches of the iron and steel industry; new enterprises are announced in the Southern States involving large expenditures of capital in mill, furnace, railway, and shop construction. Certain movements upon the part of railway builders and the managers of large manufacturing corporations lend strength to the predictions made that a permanently higher range of prices for all kinds of crude and finished products will be established during the first quarter of next year. These interests have made extensive contracts for supplies at present prices, and their example is being followed by the smaller concerns, with the effect of creating a very wide-spread demand. Whether this will result in what is popularly understood as a "boom" remains to be seen. The strongest protection against the threatened advance in railway material is that an advance would open the way for importations. Prices for all kinds of material are advancing on the other side. This fact at once protects American makers against heavy importations, but, on the other side, lays the foundation for their farther advance here. Theorizing on this subject, however, is fruitless. The controllers of large interests are deeply concerned, not only over the possibility and probability of a general advance in crude and finished material, but over the effects which such an advance may have in checking enterprise of all kinds. They remember that the unnatural advances made in 1873 helped to precipitate the panic of that and subsequent years, and they recognized that much of the present activity is due to the low prices of 1885. Trade indications could not be more gratifying. Our highest commercial authority show increasing bank clearings in the leading cities, and an increased movement in all the staple products. Railway securities are in active demand, and an old-time confidence is reviving. In jobbing circles trade is a little dull just now because we are between seasons, manufacturers are almost everywhere and in every branch running to their fullest extent because they know that the consumptive requirements will leave them with bare stocks at the close of the season. Large amounts of money are being loaned to manufacturers for building and extension purposes. Nowhere does there seem to be any dangerous tendency to speculative prices. The coal trade is active and prices are firm, and the combinations which have controlled that industry are discussing plans and measures by which they will realize better margins next year than this. A great deal of railroad building has been projected within a week. More mileage is in contemplation now than in our railroad history. Most of the construction will be in the West and Northwest, whence the most favorable traffic and dividend returns are received. As long as railway construction can be relied upon at its present limit, so long can we have confidence in the continuation of building activity. Western building authorities are highly gratified over each succeeding week's developments in manufacturing and building. The lumber trade is strong, and prices are firmly maintained in Eastern, Southern, and Western markets. In the Northwest manufacturers have been encouraged by heavy orders from the East to crowd their capacity. Heavy receipts continue from the Southeast, and tonnage is pretty well employed for the rest of the season. A large amount of lumber is awaiting shipment in the Gulf and South Atlantic ports to Northern ports. Northern buyers are ready for it. The probabilities are that while lumber will remain high in price, no general attempt will be made to crowd prices beyond their present limit. The recent movement of labor organizations contain some assurances that a conservative management will be in the saddle next year. The trade unionists will meet in Ohio next month, and will probably express opinions which will be in accord with the true interests of labor. A jealousy exists between the trade unionists and the Knights of Labor, which is natural and which will not be eradicated easily. These two powerful branches will exert a controlling effect upon each other. The trade unionists, if left to themselves, would make no demand for shorter hours at this time. An influential faction will argue that it will be necessary for them to favor an eight-hour agitation in order to maintain their position as an organization, and do something positively popular in order to maintain their prestige as against the Knights of Labor. The Knights, as a body, favor an eight-hour or shorter-hour movement, but their leaders have taken decided grounds against a movement which involves so many risks. They prefer to direct their attention at the present time, and perhaps for the next two or three years, to the work of organization, to the putting up of machinery for the government of their intricate organization. Their leaders desire to avoid strikes because in the majority of cases they have come out second best. The trade unionists will aim to render better service to labor than the Knights, and both will endeavor to gain and cover all the ground they can. In the meantime, the employers of labor are quietly but actively at work, The Philadelphia master-builders have effected an organization which will put them in a better condition than they have been. The building interests in Chicago are endeavoring to strengthen themselves, and there is a feeling throughout the entire West that the disorganized condition of employing interests is not a wise one, and that it cannot be too soon remedied.



PHOTO-GRAVURE CO.

THE MANHATTAN STORAGE WAREHOUSE, NEW YORK, N. Y.

JAMES E. WARE, Architect.

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THE accumulation of back numbers of the *American Architect* has become so cumbrous that we have decided to follow the rule adopted by other publishers, and hereafter we shall keep in stock only the issues of the preceding five years. With the first of the year, the numbers of this journal issued between January 1, 1876, and December 31, 1881, will be "ground up" for paper stock. It is a great waste of good material, but it cannot be helped. Between this time and the end of the year, architects who have had designs, or writers who have had articles published in these moribund issues, and would like to procure extra copies of them can do so now by purchasing not less than ten copies of the paper containing them, at the rate of five cents per copy. Draughtsmen and others who have not the issues of the above-named six years, will find this a good opportunity to procure valuable professional material.

BOSTON is in the midst of a discussion about the enlargement of the Massachusetts State-House, which stands in the most conspicuous situation in the city, and has become too small for the business to which it is devoted. One or two volunteer plans are said to be in process of preparation for the enlargement, but of these the general public knows little or nothing, and contents itself with discussing the methods in which additional ground shall be secured for the extension. The most obvious way of obtaining this would seem to be to condemn and appropriate the necessary territory adjoining the west side of the present State-House lot, which can be done without inconvenience, but this will be expensive, and a large party of citizens, headed by the Mayor, wish, instead of this, to take a row of houses across the street from the present State-House, together with a large vacant lot at some distance beyond, separated by other streets, and at a much lower level than the State-House, and utilize them for building detached structures for the State business, connecting them with each other, and with the old building, by means of covered bridges. As we understand from the newspapers, any one who criticises this plan, which will cost about a million dollars less than the other, is denounced as an architect hungry for the job of spending an extra million of the public money; but we are willing to run the risk of this for the sake of fulfilling what we conceive to be our duty in protesting against any such mean and ridiculous scheme. If the State of Massachusetts were in the last stages of poverty, or had recently repudiated its debts, or were for any other reason compelled to adopt a miserable makeshift in place of a decent and convenient arrangement, we would not say a word; but it is not; and we do not believe that its inhabitants, if they can be brought to understand the plan, will ever consent to have its principal building, the seat of that Great and General Court which has managed its affairs so well for two hundred years, made into a laughing-stock for the people of other communities. Let the citizen who thinks that his part of a million dollars is worth saving imagine, let us say, that he receives a visit from a cousin living in Texas, or Georgia, or Indiana, or any one of a dozen commonwealths, not half as rich or cultivated as Massachusetts, which have recently erected magnificent public buildings; and that he sets out with him to show him the architectural glories of Boston. "You remember the State-House, don't you?" he asks, pointing with just pride to the splendidly situated little building with its gilded dome. "Oh yes," the Texas man replies, "but how small it is. The whole affair would about go into the rotunda of our State-House. Besides, I thought it had been enlarged recently." "So it has;" answers the Bostonian, "there is more of it across the street, over in that corner;" and as they pass under the "covered bridge" which ties, as in a planing-mill, the nearer portions of the seat of government, he points down the hill and adds, "There is still more of it down there, behind those little buildings, where you see the engine-house. You can get to it from here by going through this building, then down three flights of stairs, and across a bridge, and then down another flight of stairs, which brings you to the Hall of State." The Texan coughs slightly, and makes no answer as his host eagerly explains that by this system of planning the State saved a good deal of money, besides utilizing an unsaleable lot which paid no taxes, but we venture to say that before the Bostonian gets home with his guest he wishes that this particular economy had not been necessary, and if he could have the business done over again he would vote to make the State-House more like those which other respectable people build. What, we should like to ask, would be thought in Boston of a man who built a part of his house in a good situation, and to save expense, bought sites for the remaining rooms in his neighbor's back yards, connecting them together by "covered bridges?" There is no place, perhaps, where a man who economized in this way would be more unmercifully laughed at, and yet the Mayor of the town seriously proposes that the City and State shall spend three million dollars in making themselves similarly ridiculous, and, what is worse, many of the inhabitants favor the scheme.

THE other argument of the friends of the economical plan, that the proportions of the present State-House will be left by it undisturbed, has weight mainly on sentimental grounds. The building is well proportioned enough, and crowns with remarkable grace the distant outline of the city, but its principal claim to preservation rests on the associations connected with it. The gilding on the dome we could ourselves cheerfully see dispensed with. We can remember when there was nothing but yellow paint on it, and the gold-leaf coating, which has to be renewed every ten or twelve years, and costs each time nearly as much as the entire original cost of the dome, adds very little to the appearance of what is, unfortunately, a combustible mass of woodwork, which menaces every day the destruction of the valuable property stored beneath it. If the building can be enlarged without altering the present central portion, there are many reasons why this should be done, leaving the reconstruction of the central portion to the time when it shall have become too rotten or rickety to stand up any longer; but for the permanent part nothing ought to be thought of for a moment except the most convenient and dignified building that the State of Massachusetts can obtain, not highly ornamented, if the people wish to save expense, but at least not divided into fragments, and distributed among the cheap lots in the neighborhood.

THE New York Board of Aldermen have just contributed to the amusement of mankind by solemnly, and with a very large majority of votes, passing a resolution to the effect that "for the better protection of life and travel in the city, no steam-heating pipes hereafter laid shall be allowed to carry more than fifty pounds to the square inch, and that all permits heretofore given for more than this pressure be revoked." Although a faint show of reasons in favor of this movement was made, it is understood that it is simply an

attack upon the New York Steam Company, which has, for some reason, incurred the malice of the labor reformers. As this company, in order to deliver steam at a distance under a suitable pressure for hoisting and other machinery, must keep that in the mains nearest its boilers at a tension of considerably more than fifty pounds, it is obvious that the compulsory reduction of the pressure in the mains will necessitate the abandonment of contracts for furnishing high-pressure steam at a distance, and a more vicious blow could hardly have been aimed at the company. The officers of the latter represented, with considerable force, that their pipes took the place of steam-boilers, which in New York are very commonly placed under the sidewalks, and that such boilers, which are by ordinance allowed to carry one hundred pounds pressure, are a good deal more dangerous to "life and travel" than pipes under the same pressure; but this reasoning did not seem to be favored with the slightest attention. On the contrary, the principal advocate of the resolution explained that the company was a "monopoly," and that if it were not allowed to supply steam, the owners of buildings would be compelled to put in boilers and employ engineers; and he might have added, with truth, that these engineers and their friends would probably vote at the next election for the return of their official benefactors to their high station. This reasoning must have sounded rather strangely from the Board which granted the Steam Company its permission to lay pipes in the streets, and, to do the gentleman who offered it justice, he supported his theoretical objections to the company's operations by informing his auditors that "the frequent bursting of the pipes created malaria in the ground, which was dangerous to health." By the bursting of pipes we suppose that he must have meant the leakage of joints, as we do not remember the bursting of any of the company's pipes; but the notion that the steam "creates malaria in the ground" is a novel one. It is not many months since certain Boston officials were zealous in compelling the application of steam, under a patented process, to bales of rags, for the purpose of destroying the malaria contained in them, and the idea that what cures in Boston will kill in New York seems at least to lack a precise scientific foundation. As to the other dangers to be apprehended from the tension in the pipes; to say nothing of the expediency of substituting ancient steam boilers, in charge of average New York engineers, at one hundred pounds pressure, under the sidewalk, instead of the Steam Company's pipes at fifty pounds pressure, under the roadway, it may do no harm to recall the fact that another company was once very near getting possession of the streets of New York, which proposed to carry, not steam, but hot water, under a pressure of more than three hundred and fifty pounds to the square inch, in pipes beneath the roadway. Nothing was heard then about risk from malaria, or of the evil nature of monopolies, and very little about the real danger of the scheme; yet it is speaking within bounds to say that the peril to the public from the hot-water pipes would have been a thousand times as great as that which it suffers from the presence of the Steam-Heating Company's mains under the usual pressure.

WE notice that an attempt has been made among the poor pork-packers in Chicago to organize a coöperative packing-house on their own account, and that, being supported by the best workmen in the business, as well as by persons outside who would like to do something to help their fellows out of their trouble, it would very probably have been successful before now except for the opposition of the socialist leaders. That these gentlemen would oppose any such scheme was certain from the beginning, Satan himself not being more averse to holy-water than professional socialists and labor agitators to anything like coöperation or participation in profits among their dupes; but it is both surprising and saddening, as showing the power of the terrorism by which they domineer over the poor and helpless, to find that men of courage and substance enough to begin the enterprise should hang back because they cannot get the socialists' approval. According to the Associated Press despatches, the argument brought against the scheme in the socialist meetings is that it is "simply a coöperation of individuals in a corporation to gain money," and, if successful, the members would "acquire some wealth and thus adopt monopolistic tendencies;" and with these ridiculous pretences, as it appears, the measures for interfering with the scheme are to be justified. We should like to know how long in this country men who have the desire and the ability to work economically and effectively, and save up a little money to keep their wives and children out of the almshouse in time of misfortune, or, if their affairs are prospered, to serve as the foundation of an honest competency for their later years, are to be prevented from doing so by fear of the vengeance of labor organizations, the most prominent figures in which are usually those who use them simply, after extracting an easy living out of them, to discourage and degrade those whose superior skill they envy and hate. According to the accounts, the strike among the packers at Chicago which caused the distress out of which this movement for relief has grown was caused by an infamous and wanton trick on the part of one of the higher officers of the Knights of Labor, who, being a candidate for election to some profitable public position, conceived the idea that if the voting workingmen in his district should go on strike at the time of the election, he could depend upon their leisure for a full vote, and on their loyalty to their organization for securing their ballots for himself; and therefore issued an official order calling out all the men over whom his position in the order gave him authority. The order was obeyed, with that touching faithfulness characteristic of the "little people" whom such demagogues misuse so shamefully, and the men abandoned their work. As soon as intelligence of the strike reached the head of the organization, a thousand miles or more away, the order for it was countermanded, and the men directed to return immediately to their places. This decree, according to the press despatches, was telegraphed to the local official, the very man who ordered the strike, and who probably expected such a communication. Unfortunately for the workmen, it came before the election, and their worthy official, who had not yet used them as he wished, put it in his pocket until they had served his purpose. When he got through with them, as there was no further reason for withholding the order, he had it published; but by that time the packing-houses had got other men, or made different arrangements, and the victims of this atrocious fraud found themselves adrift in the streets. Now, as it seems, they are trying to undo the mischief inflicted upon them, by finding means of providing themselves with work and a livelihood, and are thwarted at every step by other professional "friends of labor," who, to judge from their talk, vie with their political friend in efforts to prevent them from "acquiring some wealth." The example of the Massachusetts coöperative shoe factories shows how successful these efforts are likely to be, but we are not without hope that in Chicago, the most energetically public-spirited, perhaps, of all our large towns, some way may be found for securing to the poorer citizens a little more liberty in the "pursuit of happiness" than is at present enjoyed elsewhere.

THE *Sanitary News* quotes from the London *Morning Post* an article upon the condition of the water-supply in the east end of that city, which shows a curious state of affairs. It seems that the London water companies publish monthly reports of the condition of the water supplied by them, and from these reports it appeared that the east-end water was "entirely free from living organisms," so that the *Morning Post* sarcastically observes that the "organisms" in the water must have been too large to get into the microscopes, and therefore escaped the vigilance of the examiners, but that it was certain that "organisms" eighteen inches long, in the shape of eels, had been found by some of the Company's customers in their pipes, and several of them had been made very ill by drinking water in which similar animals had died and decayed. The Company's officers, on learning this fact, hastened to explain it by saying that about three years ago, some of their filter-beds burst, and the unfiltered water which got into the mains carried with it some small eels and other fish. These, particularly the eels, came to enjoy their new home in the pipes, and not only grew but multiplied, so that there are now many of them there, ready to be drawn into the small pipes by the opening of a faucet, there to stick, and die, and decompose. How eels, or any other fish, can live and grow to be eighteen inches long, in iron pipes, containing only water from which every trace of "organisms" has been filtered out, no one seems inclined to explain, but they are certainly there, and, in spite of the efforts of the Company to flush them out, they seem to be increasing rapidly in numbers. What will be the end of the nuisance, we cannot pretend to say, but it is likely to be a serious one while it lasts.

EARLY SETTLER MEMORIALS.[1] — IV.

INDIAN MONUMENTS.



THE most sensible public monument in the United States, of which we have any knowledge, was erected in Stockbridge, Mass., in 1877, in the old Indian burying-ground in that village. It is in memory of the Stockbridge Indians, and consists of an unhewn shaft of stone, found in the vicinity, and a base made of rude boulders. In the summer and autumn months a beautiful vine covers the entire structure.

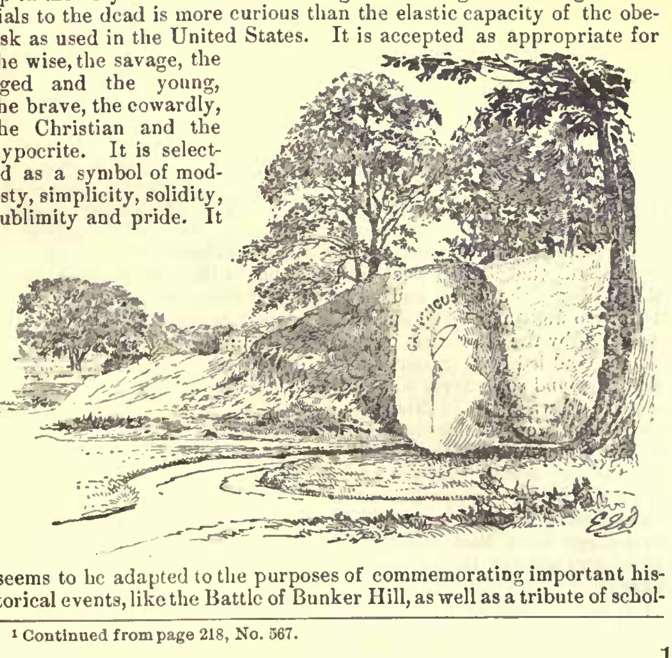
THE UNCAS MONUMENT, NORWICH, CONN.

The citizens of Norwich had long been desirous of erecting some memorial to their "old friend," the Mohegan sachem. During the summer of 1833, Andrew Jackson, President of the United States, with a part of his Cabinet, made a tour through a portion of the Eastern States. The citizens of Norwich wished to have him include that place among those he proposed to visit, and as an excuse for inviting him to do so they suddenly decided to lay the corner-stone of a monument to Uncas, to whom they were indebted for the very existence of the town. The invitation was accordingly given and accepted, and the corner-stone was laid in the presence of a large assembly of people, including a few Indians.

Though the corner-stone was thus auspiciously laid, no funds had been obtained or plans matured for the erection of the monument. But the ladies of Norwich with a spirit characteristic of the sex, took the matter in hand, by holding a fair in 1840 on the occasion of a mass-meeting in honor of Harrison and Tyler, and with the funds thus obtained erected a simple granite obelisk, with no inscription but the name — UNCAS — cut in raised letters on the base. It was coarsely executed in Quincy granite at the State Prison in Charlestown, Mass., under the direction and supervision of G. L. Perkins, Esq., and dedicated July 4, 1842, in the presence of a large concourse of people, with an address by Wm. L. Stone, Esq. It stands in Sachem's Burial Ground, which is the only aboriginal relic of any note in the town of Norwich, and the place of burial exclusively set apart, by the early settlers and the Mohegan chief, for the Uncas family.

Uncas died in 1643. Of his character there is a difference of opinion. Many declare that he left no very favorable record. General Gookin describes him as follows: "Unkus, an old and wicked man, a drunkard, and otherwise very vitious; who hath always been an opposer and underminer of praying to God." Others affirm that from the day when the Pilgrim Fathers planted their feet on the soil of Connecticut, this noble chieftain became their friend, and such he remained until the day of his death, involving a period of over half a century. And because of his fidelity very little English blood was shed by Indians upon the soil of Connecticut, while the border towns of Massachusetts were ravaged by scores.

Nothing could be more incongruous than an Egyptian obelisk set up in memory of an American savage. Nothing concerning memorials to the dead is more curious than the elastic capacity of the obelisk as used in the United States. It is accepted as appropriate for the wise, the savage, the aged and the young, the brave, the cowardly, the Christian and the hypocrite. It is selected as a symbol of modesty, simplicity, solidity, sublimity and pride. It seems to be adapted to the purposes of commemorating important historical events, like the Battle of Bunker Hill, as well as a tribute of scholars to the memory of the founder of a great university, like the obelisk over the grave of John Harvard. Thomas Jefferson desired it as his monument, in the hope that it would not be carried away by relic-hunters. The United States Government built an enlarged obelisk in memory of Washington, because it was supposed to best agree with his character, and was the form that could be built to the greatest height for the smallest sum of money.



However slight it may be, there is a certain appropriateness in the Canonicus boulder, and it does not produce, as the Uncas monument, the unpleasant impression of pretence and incongruity in the mind of the observer. When this obelisk was being constructed, there was a great deal of anxiety concerning the right way to spell the name of the Mohegan chieftain, but history fails to shed any light as to whether any one was interested in selecting a form for his monument that would in the slightest degree allude to any phase of his life or character.

The Uncas monument is in keeping with its origin, showing neither care for, interest in, nor appreciation of him as a representative Indian, or his vital relations to the settlers of Norwich and the Colony of Connecticut. An obelisk, no matter how well made, has never had any human interest as a memorial of the dead. It has, however a universal interest peculiar to its origin and purpose. Its form, according to modern interpretation, is the easiest and cheapest for grave-yard purposes, a convenient excuse for want of thought, and an accepted apology for ignorance. A large obelisk is an excellent and popular means of gratifying vanity. To be able to say that "it is the largest piece of granite ever quarried in the State" more than makes up for the absence of all the fine qualities of the human heart as expressed in other times in tributes to the dead. The Egyptians, though making their obelisks works of art, cut upon their sides some allusion to the human being, whose deeds were worth referring to, if by nothing more than a symbol. The one to poor Uncas has no more significance than it would have if it was set up for bean-vines to grow around.



THE MIANTONOMOH MONUMENT.

As late as 1770, there stood on Sachem's Plain, in the eastern part of the town of Norwich, a heap of rude stones between two solitary oak trees. It was an Indian memorial that had been gradually gathered since the death of Miantonomoh, the sachem of the Narragansetts. Being near an Indian route often travelled, it was visited by scouting parties of different tribes, and additions made to it alike by exultant foes and bewailing friends. All true-hearted Narragansetts who passed that way renewed their lamentations and cast a few more stones upon the heap, consecrating them with doleful cries and frantic gestures. Sachem's Plain was first made memorable by a battle between the Mohegans, under Uncas, and the Narragansetts, under Miantonomoh. The latter was taken prisoner and his warriors beaten and routed. Historians are not fully agreed whether the many-stoned pile marked the spot of the capture, execution, or grave of the Narragansett chieftain. The owner of the land, having no respect for this rare example of an aboriginal memorial, basely used the stones for the menial purposes of a barn foundation, the trees vanished in sympathetic protest against this shameful desecration, and nothing was left to mark the spot except a barren break in the ground upon which the grass refused to grow. On July 4, 1841, a few citizens of Norwich, led by Wm. C. Gilman, Esq., erected two blocks of granite upon the spot, reaching to the height of eight feet, and cut upon the top stone the simple inscription

MIANTONOMOH,
1643.

Of the character of this chief there is also a difference of opinion, evidently tempered by localities. In Connecticut he was regarded as an implacable and treacherous foe of the Indians and white settlers of the colony around Norwich; as possessing not one redeeming quality, and that the only act of his life deserving especial commendation was his reported order to those of his warriors who went

[1] Continued from page 218, No. 567.

against the Pequots, to spare the women and children. He was slain after he had been taken prisoner on Sachem's Plain, by the brother of Uncas, or one of his warriors, under the authority of the Colony of Connecticut, as a necessary and just punishment for repeated attempts to assassinate Uncas. The Rhode Island authorities, who held him in high esteem, regarded the death of Miantonomoh as no less than murder.



The rude style of the monument and its isolated position are quite in keeping with the savage nature it commemorates.

CAPTAIN JOHN MASON'S MONUMENT.

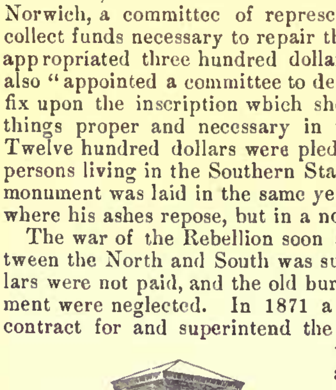
The record of Mason's death, in Rev. Simon Bradstreet's journal, is as follows: — "Jan: 30, 1671 (O. S) Major Jno. Mason who had severall times been Deputy Govern[r] of Connecticut Colony dyed. He was aged about 70. He lived in the 2 or 3 last years of his life in extream misery with ye stone or strangury or some such disease. He dyed with much comfort and assur[e] it should be well with him."

"Captain John Mason," writes Miss Caulkins, one of the historians of Norwich, "was one of the boldest champions of New England, the conqueror of the Pequots, and the preserver of the infant colony of Connecticut. He bore a large share in the hardships and dangers of the first settlement of the State, fought desperately in her first Indian wars, and assisted in her earliest councils.

"He sustained also for eighteen years the office of magistrate, and for ten years that of Deputy Governor of the Colony. On the settlement of Norwich he was one of the first movers, and may justly be considered the chief founder of the town. The last twelve years of his life were passed in the infant plantation, and here he died. According to tradition he was buried upon an undulating hill, near the Yantic River, in a spot reserved by the first settlers for a common place of sepulture. It is long since the grave of a single individual could be discriminated. The whole area, however, covered with graves was but eight or ten rods square, and within that space was the sepulchre of the hero. With so many claims to the gratitude and admiration of his countrymen, it is surprising that Captain Mason should have lain so long in an unnoticed grave. For 187 years he has reposed in the very center of his exploits, without a stone, or even a hillock of turf to mark the hallowed spot."

In 1859, on the two hundredth anniversary of the settlement of Norwich, a committee of representative citizens was appointed to collect funds necessary to repair this old burying-ground. The town appropriated three hundred dollars for a monument to Mason, and also "appointed a committee to determine the site for the same, and fix upon the inscription which should be placed thereon, and do all things proper and necessary in the erection of said monument." Twelve hundred dollars were pledged for the first object, largely by persons living in the Southern States. The corner-stone of Mason's monument was laid in the same year, not in the old burying-ground where his ashes repose, but in a new cemetery laid out by the town.

The war of the Rebellion soon after breaking out, intercourse between the North and South was suspended, the twelve hundred dollars were not paid, and the old burying-ground and the Mason monument were neglected. In 1871 a new committee was appointed to contract for and superintend the erection of such a monument as they should deem proper. They accordingly erected one at a cost of six hundred and fifty dollars, on land *adjacent* to that where the corner-stone had been laid in 1859. It bears the following inscription, as well as the names of thirty-six of the early settlers of Norwich: "Major John Mason, born in England, died in Norwich, January 30, 1672, aged 73."



One hundred and fifty dollars of the monument-fund remained in the hands of the committee after the monument was erected, and they thought best to reserve it for the purpose of keeping the monument in repair, and erecting in 1959 a larger and more imposing one on the green in Norwich town.

With this object in view, a company of fifteen of the principal citizens was incorporated by an act of the General Assembly of the State, in May, 1871. The site has been purchased, and the funds deposited in a savings bank, where, if carefully preserved, and the interest compounded semi-annually, it will amount to a very large sum in 1959.

If after two hundred years there existed only enough public spirit and gratitude in Norwich to cut the names of Mason and his fellow-settlers on a piece of granite, it may be safely concluded that at the end of another century they will be entirely forgotten. So far as the monumental story of Mason and his savage contemporaries goes, they are all on a level in the respect of those who have come after them. The savage friend, the implacable foe, and the sturdy preserver of the colony are one and the same. The Mason monument is the dreariest specimen of monumental mimicry we know of.

THE NORWICH SOLDIERS' MONUMENT.

This is one of those terrible objects in granite that began to come into vogue soon after the close of the Rebellion, and which have continued to increase until the present time. It consists of a piece of granite twelve feet high, cut in resemblance of a Union soldier, standing upon a pile of granite fifteen feet high. The cost of this pile was $18,000. Its history is in harmony with its character. Failing to collect money enough by voluntary subscriptions to build a memorial to the soldiers who risked and gave life and limb for their country, the town was obliged to lay a tax of fifteen cents on $100 of the assessment list. The committee who had charge of the affair was Hon. Wm. A. Buckingham, Hon. John T. Waite, and Hon. J. A. Hovey. So little is the monument regarded, that neither its designer or maker are mentioned in the "*History of Norwich.*"

If it is possible, it is more heartless than the Mason monument, because it is more pretentious, and because the purpose for which it was erected comes closer to human sympathy and grateful remembrance.

BATTLE OF GROTON HEIGHTS.

The battle of Groton Heights was not only the largest and most important military engagement that ever took place within the borders of Connecticut, but it was one of the most tragic and heart-rending events that ever occurred on this continent. Benedict Arnold, in command of three thousand British troops, sailed into New London Harbor on the morning of the 5th of September, 1781. While more than two-thirds of this force were, under his personal direction, burning, sacking, and outraging the inhabitants of the towns of New London and Groton, in the early part of the next day, the remainder were sent to attack Fort Griswold, which was situated in the latter town across the river from New London. The fort was mounted with thirty-three cannon of various sizes, and defended by one hundred and sixty white and two colored men, under the command of Colonel William Ledyard. This little garrison was composed of militia-men, continental soldiers, and citizens in all ranks and ages, with little training as artillerists, and hastily gathered together at a moment's notice. Before the assault began Ledyard was called upon to surrender, but he refused. After repeated assaults and a most persistent defence he was obliged to surrender to superior numbers. As Colonel Ledyard advanced to meet Major Bromfield, the commander of the British troops, the latter called out, "Who commands this fort?" "I did, but you do now," said Colonel Ledyard, extending his sword. In a moment Ledyard lay dead, thrust through and through by his own sword in the hands of the treacherous Briton.

The death of Colonel Ledyard was immediately followed by an indiscriminate massacre of the garrison, both wounded and living, until fifty-five were killed and entirely stripped of their clothing — many of them receiving several, and some thirteen bayonet stabs. Thirty-six of the dead were under forty years of age. One boy died there at fifteen, and another at seventeen years of age; one man at sixty, another at sixty-five, and another at seventy-five. Sixty of the dead and wounded were members of the Congregational churches of Groton and New London. Of the entire garrison all but eighteen were unmarried. Eleven bore the name of Avery, six of Perkins. Eye-witnesses state that the fort ran with streams of blood. Of those who survived this barbarity, thirty-five, more or less dangerously wounded, were parolled, and as many more, mostly wounded, were taken prisoners to New York. Most of them fought in sight, and all within hearing of their own friends.

"Not till the British fleet disappeared in the darkness on that fatal day did the wives and children, or fathers or mothers go to the fort to find their loved ones dead among heaps of slain, literally butchered by the barbarism of a civilized people worse than that of savages, and led by a traitor who in other years had known every foot of ground so bravely consecrated to a noble memory." Benedict Arnold was born in Norwich.

The dead were so thickly covered with blood and dirt and disfigured with wounds that their friends could not distinguish them. It is told of one woman that she washed the faces of thirty of the killed before she found her own husband.

The British lost one hundred and ninety-three officers and men — thirty-three more than were in the garrison — including the first and second officers in command. They made forty-four American widows.

The heroic, pathetic and appalling scenes which that 6th of September witnessed on Groton Heights would fill a book. Ledyard

himself was only forty-three years old. He left his wife on a sick-bed with a new-born child, to go to the fort, and, as he stood on its walls, whose construction he had directed, he saw the assaulting column trample over the newly-made grave of his daughter as it passed through the burying-ground. "What a story is this of Walter Buddington and his wife and child, who, in their home above the fort, ate their breakfast in silence and haste and, after the breakfast, he took down his musket from the deer-horn hooks above the mantel, and started for the fort. And all that dreadful day his wife and daughter sat upon the rocks and watched the battle and the conflagration, and never knew for a certainty whether husband and father was dead or alive until months afterwards the sickly and starved survivor of a prison-ship staggered across the familiar threshold and was at home again."

And such a piece of cruelty as this: "The British loaded the wounded members of the garrison into a cart and let it run down the hill without guidance until it struck against a tree, killing some of its occupants and horribly torturing the others." And this: "there was a well of water in the fort and, though its wounded defenders were dying of thirst, their conquerors refused to permit them to have a drop." The destruction of property amounted to more than $300,000. One hundred and sixty-five buildings and a number of vessels were burned.

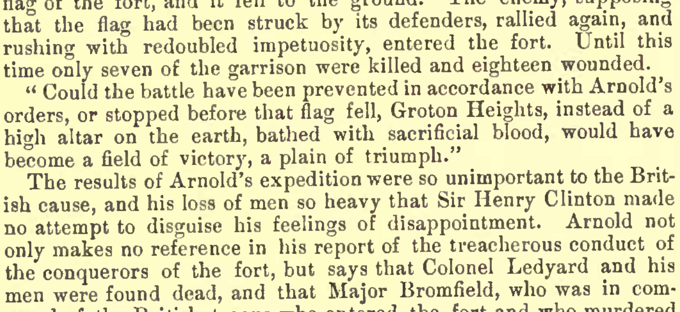
The horrors of the massacre were made still more terrible by two fateful incidents which took place, one before and the other during the fight. Arnold says, in his report to Sir Henry Clinton, that "on gaining a height of ground in the rear of New London, from which I had a good prospect of Fort Griswold, I found it much more formidable than I expected — and, observing that it had received reinforcements from Fort Trumbull, I countermanded my first order to attack the Fort, but the officer arrived a few minutes too late. The attack had commenced." After the two chief officers of the assaulting party had been killed, the troops under them became discouraged and were about retiring, but a luckless shot cut the halyards of the flag of the fort, and it fell to the ground. The enemy, supposing that the flag had been struck by its defenders, rallied again, and rushing with redoubled impetuosity, entered the fort. Until this time only seven of the garrison were killed and eighteen wounded.

"Could the battle have been prevented in accordance with Arnold's orders, or stopped before that flag fell, Groton Heights, instead of a high altar on the earth, bathed with sacrificial blood, would have become a field of victory, a plain of triumph."

The results of Arnold's expedition were so unimportant to the British cause, and his loss of men so heavy that Sir Henry Clinton made no attempt to disguise his feelings of disappointment. Arnold not only makes no reference in his report of the treacherous conduct of the conquerors of the fort, but says that Colonel Ledyard and his men were found dead, and that Major Bromfield, who was in command of the British troops who entered the fort and who murdered Ledyard, behaved with great honor. British historians accepted this report, but Botta very justly pronounced it a piratical expedition, of no value to the British, and signalized by the most horrible devastations. It was the end of Arnold, as the British never afterwards entrusted him with a command.

THE OLD GRAVESTONES.

The martyrs of Fort Griswold left to their widows and orphans poverty, debts, and suffering. Yet, the gravestones these bereaved and desolate families erected, form, even at this day, not only the best collection of revolutionary memorials to be found in the entire country, but they are the best examples of the different styles they represent. They have an added interest and superior significance very rare even in these more favored days, in that they are the very best expressions of cemetery memorials that could be obtained at the time of their erection. No gravestones since erected in the United



States have anything like such excellent proportion, imposing style, such complete fulness of design. We regret that we can give but three examples of the fifty-two erected.

"On visiting these solitary places of interment and reading from the stones the rudely-cut epitaphs which sometimes breathe a spirit of resignation and Christian hope, but far oftener that of defiant and fiery indignation, the visitor realizes more than ever before the extent of the desolation and woe spread throughout this region by the invasion of the traitor."

INSCRIPTIONS AND EPITAPHS ON THE OLD GRAVESTONES.

"In memory of Mr. Rufus Hurlbert, who fell in the bloody massacre committed by Benedict Arnold's troops at Fort Griswold, September the 6th, 1781, in the 40 year of his age.

"Reader consider how I fell For liberty I blead Oh then repent ye sons of hell For the innocent blood you shead."

"Will not a day of reckoning come does not my blood for vengeance cry how will those wretches bear their doom who hast me slain most murderously."

"By God's decree my bounds ware fixt, the time the place, the means though vile, & whilst I blead, the views of bliss, Faith triumphed over Monster Death."

"Ye patriot friends that weep my fate As if untimely slain Faith binds my soul to Jesus' breast And turn my loss to gain."

"This gallant soul when God Doth call doth give his life in freedom's cause; a sudden dart doth wing away that pricous life that dwells in clay."

Save the old burial-ground at Plymouth, there are no localities in the United States so touching as the graveyards of Groton, and those of the immediate vicinity, where repose the sacred dust of these defenders of their country. T. H. Bartlett.

[To be continued.]

CONVENTION OF THE WESTERN ASSOCIATION OF ARCHITECTS.[1]

SECOND DAY.



Coupled Capitals from the Cloister Vaison.. From Revon.

The convention was called to order one hour late, and the reading of the minutes of the previous day's session was dispensed with. Mr. D. Adler presided, and Mr. John W. Root acted as secretary.

The Executive Committee reported the following members for election: Fred. Kees, Minneapolis; F. J. Grodavent, Leavenworth, Kans.; Merritt J. Reid, Evansville, Ind.; J. Mulvey, Aurora, Ill.; Wm. Zimmerman, Chicago, and they were elected.

As several members were yesterday admitted under a misapprehension of the rules requiring all members to be exclusively engaged in the practice of architecture, it was voted that their election be reconsidered, rescinded, and the persons so elected be notified that they were ineligible.

Mr. C. A. Curtin, of Louisville, moved that the same action be taken concerning the members elected at previous conventions. It prevailed.

Mr. W. W. Boyington, chairman of the committee on raising the standard of requirements for admission, reported that Article 4 of the Constitution covered all the points necessary.

Mr. Sydney Smith, of Omaha, moved that all applicants be voted on by ballot by members in open convention, and that five votes against an application be enough to defeat it. This was discussed by Messrs. J. W. Yost, of Columbus, O.; F. G. Corser, of St. Paul; Sidney Smith, of Omaha; P. P. Furber, St. Louis; C. A. Curtin, of Louisville; and E. F. Fassett, of Kansas City. After two members had offered amendments, and had them defeated, Mr. Smith's motion was carried.

Mr. J. F. Alexander, of Lafayette, Ind., moved that the Secretary be authorized to furnish each member with a properly-engraved certificate of membership, under the seal of the Association.

Mr. L. S. Buffington moved that the Board of Directors issue to each member a certificate of good standing in the profession, and that the bearer is now and has been in actual practice three years. Some objection was made to this, and Mr. Buffington's suggestion was defeated. After a lively discussion the subject was postponed until next year.

Telegrams were read by the secretary, from Mr. A. J. Bloor, on behalf of the Board of Trustees of the American Institute of Architects, stating that Mr. W. L. B. Jenney, of Chicago, was directed to represent the Institute at this meeting, and sending greetings to the sister association of the West.

A paper was then read by Dr. Oscar C. DeWolf, Health Commissioner of Chicago, on "The Relation of State Medicine to the Profession of Architecture." State medicine was "like wit, much talked of, not to be defined." What if a man employ the lineal descendant of Vitruvius Pollio to design a mansion, if the sanitary conditions be disregarded by the State? Without State medicine the architect may build a house in vain. He may successfully cope with the vicissitudes of climate; he may provide for seismic phenomena, etc., only to find his best efforts set at naught by conditions which legalized authority alone can satisfactorily adjust or remedy. It may be true that some architects are open to the charge of being behind in sanitary matters, but not those who belong to the Western Association

[1] Continued from page 254, No. 570.

of Architects. Some architects experience trouble by not recognizing its root, the essential difficulty being cost.

Dr. DeWolf then took up vital statistics, showing that vitiated air greatly increased the sickness and deaths from lung diseases. A charter of health should show a house to be non-dust-collectable, easily purified of impurities, free from damp, filled with daylight, supplied with pure air, kept at an even temperature, and supplied with pure water. He told of the attempts which would be made to secure the passage of a law regulating sanitary building in Illinois, to supplement present legislation. He compared the health of Pullman, with its sanitary regulations and conditions, with Hyde Park of which it is legally and territorially a part, showing the death-rate in Hyde Park to be 15 per 1,000, while in Pullman it averages but 6.9 to 7.6 per 1,000. In closing he said: "If, as Sallust says, 'every man is the architect of his own fortunes,' you, gentlemen, are more than the architects of your own. To your professional intelligence, sincerity and skill, every man must trust for that without which fortune is but a Dead Sea fruit — a healthy life."

A paper was then read by S. G. Artingstall, C. E., city engineer of Chicago, on "Proportion of Joints and Connections in Framed Structures," in which he stated that joints were generally the weakest parts of iron constructions. They should be proportioned to resist every direct and indirect stress laid upon them legitimately. When the bearing surface on the plate is too small, riveted joints and connections are subject to injury by tearing the rivets through the plates, and by shearing the rivet when there is too low a rivet section. Rivets are better when put in hot. Rivets should be arranged symmetrically with reference to the axis of each bar. The paper also took up "pin connections," and was of such a character that a useful abstract could not be made of it. In closing, he said: "Make all parts of a joint or connection as suitable as possible; avoid all complicated or twisted pieces, particularly the bending or forging of shape iron."

Mr. W. W. Boyington, of Chicago, then read a paper treating of his personal experiences in building foundations on Chicago soil; it was illustrated by large drawings.

After Mr. Boyington finished, the committee to report upon the advisability of changing the sub-division of the standard foot of measure from duo-decimal to decimal subdivisions, reported, recommending the appointment of a committee of conference with other interested societies. Discussion on the report was postponed until some later time in the proceedings.

THE LUNCH.

Upon invitation of the Illinois Association of Architects, the members adjourned to Kingsley's restaurant, and partook of a very agreeable informal lunch.

SECOND SESSION.

The Association was again called to order in the assembly rooms at 4 : 10, and proceeded to the reading of papers, and the president called on Prof. N. Clifford Ricker, of the architectural department of the Illinois State University at Champaign. His subject was "Architectural Grammar," and in it he studied architectural types and forms, and their variations in different buildings when constructed under different costs. Each style has its genius, and genius is not exhausted. Grammar in language is a dry study, and teaches the proper arrangement of words into sentences; but it is not the only use of grammar. It should supply us with a complete body, bones, flesh and soul, of literature. Architectural grammar should be something similar. It should not only teach us how to erect the simple structure, but should show us the complete method of decoration and ornamentation. This can be done in two ways, by varying the treatment of different portions of the building, and by using the various arts of building, such as sculpture, furnishing, etc. If the different styles employed by different peoples be examined carefully, and a standard decided, it could then be judged how closely any building neared the perfect type of the style in which it is built. He paid Ruskin great credit for being the leading writer on architectural grammar, but he was more particularly wedded to the Italian and French styles. The lack of reliable text-books on architecture were deplored, and different methods practised in different schools were described and their faults pointed out. The efforts which must be put forth in this country in order to create an American style were touched upon; the natural features of the country and the growth of art in large cities gave hope for a rapid development of an American architecture.

The Board of Directors reported as eligible for membership: Henry Wolters of Louisville, F. Heer, Sr. of Dubuque, E. J. Eckels of St. Joseph, Mo., and Henry T. Kley of Chicago, were balloted on. They were all elected.

Mr. Isaac Hodgson, of Minneapolis, then read an epigrammatic paper on "Hints on a National Style of Architecture," in which he stated that in creating an American architecture, the architects were laboring under a great mistake, and a radical change must be effected. The taste of the votaries of the fickle god must be educated and enlarged. The Western Association contained the material which could be used to develop this taste. He did not undervalue the ancient styles of architecture, but the times were ripe for something other than the old types which had been put in books for years as typical styles. No temples to mythical gods were needed now, but the temples of the present day were the homes of the people, where a real God can be worshipped. All honor should be paid to the fathers of our art, but justice should be done to ourselves. The ideal style should be left in the past, where it undoubtedly belongs. It is the peaceful arts which make a people great. Our age is a glorious reality. We should strain every nerve to obtain the best result with the most simple action. Of all men and professions, ours should take the front. The legitimate profession will be held responsible for every architectural abortion, no matter by whom erected, and the architects must see that this is not the case. He stated that it was absolutely our duty at once to proclaim a higher standard and to proceed to establish a modern school, based on rational principles exclusively. The title should be the "American School of Architecture." Only members of the Western Association and the American Institute of Architects in good standing should be admitted. Members should be obliged to pledge themselves as follows: —

1. That they will faithfully and honestly, to the best of their ability, endeavor to improve the civil architecture of America, and that they will render all the aid in their power in the introduction, development and perfection of the national style of architecture known as American.
2. That in doing so, they will, in the construction of buildings of every class, be wholly governed by the laws of mechanics or scientific rules on the subject.
3. That they will confine themselves, as far as practicable, to such simplicity and breadth of design as will produce the longest unbroken perspective lines, and greatest dignity and repose in all their works.
4. That they will carefully study and practise economy — using only such quantity and strength of materials, of whatever kind, as shall be warranted and justified by the accepted authorities on the subject.
5. That they will strictly observe the law of practical fitness — excluding all barbaric crudeness, massiveness and severity, and give a truthful and spirited expression of purpose to all their creations.
6. That in the matter or fenestrations of every structure they will introduce any and every form of arch and lintel that will serve convenient, practical and æsthetic purposes.
7. Regarding columns, pillars, etc., that they will introduce parallel shafts and regulate their height by the safe value and measure of the material employed in their make-up to safely sustain the superimposed loads. And that, when in order, they will boldly and gracefully mould their bases and capitals — enriching the latter with spirited carvings representing native fruit, flowers and foliage, or geometrical patterns, or both.
8. That in all lintels, archivolts, voussiors, etc., the actual known value of the material used to sustain their own and superimposed loads shall be their dimensions.
9. That they will not project belt-courses, cornices, copings, pediments, gables, etc., over the sustaining wall-line, to a greater extent than that which is necessary for protection and, when enriched, ornamental purposes.
10. That in the roof and chimney-shafts, parapets, etc., of all their structures, they will endeavor to produce the best picturesque effects in the most unpretentious and monumental way, avoiding unnecessary breaks and, as far as is practicable, unequal angles in the roof contours.
11. That when dormers are introduced they will endeavor to make them important, not numerous, features, and gracefully embellish them to properly relieve the broad roof-surfaces.
12. That they will introduce no exterior decoration except that which is necessary to properly accentuate and relieve broad, plain surfaces — using geometrical patterns, native plants, foliage, fruits and flowers, and appropriate selections from the lower animal kingdom for the purpose.
13. That they will, in all interior decoration and finish, endeavor to produce harmony with the exterior, except where it may be necessary to vary for special and convenient purposes.

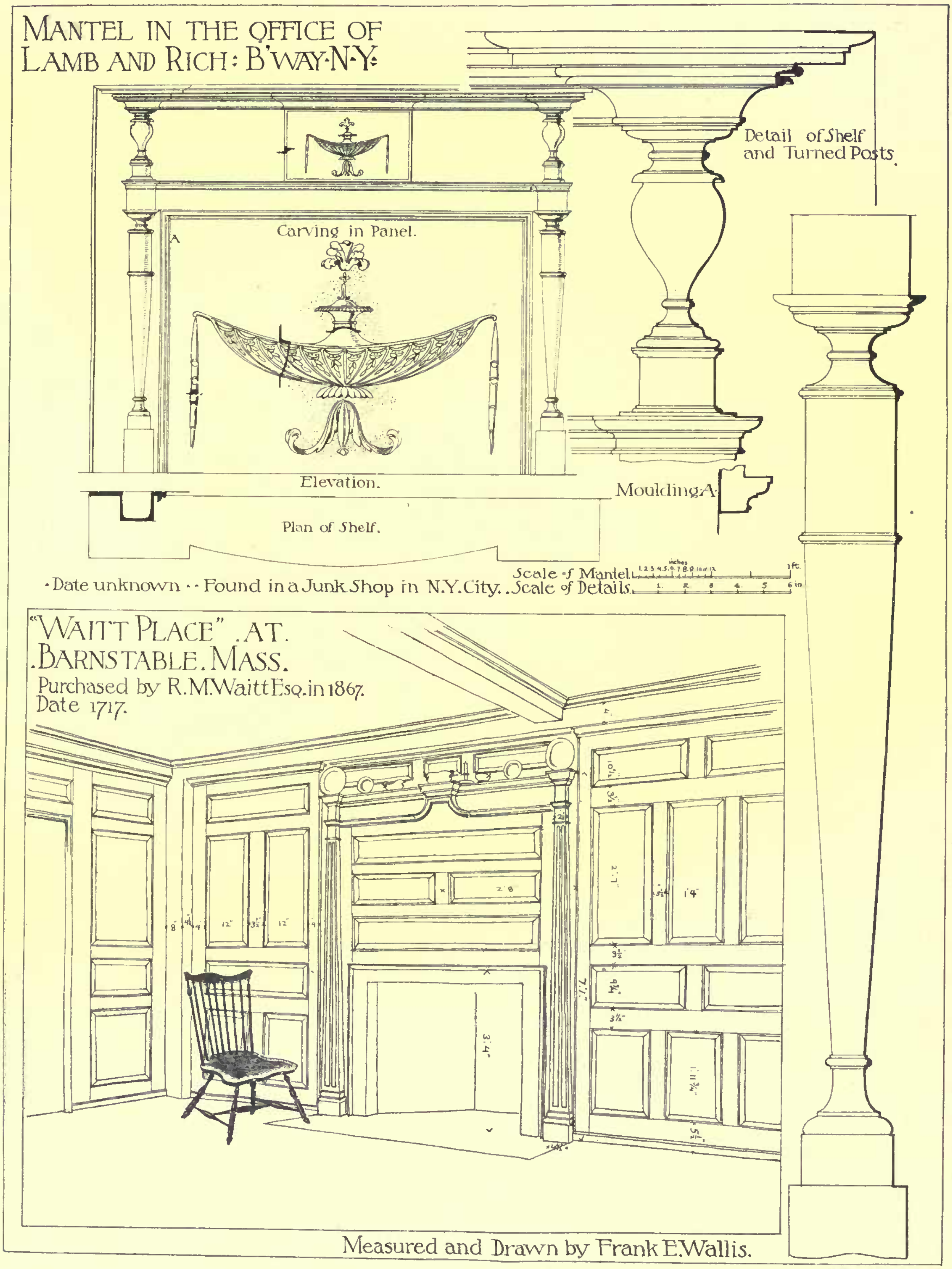
Mr. E. H. Ketcham, of Indianapolis, then read a paper on "Insane Hospitals." One in every five hundred and fifty-eight persons in Indiana is insane. In Cook County, Ill., one in every three hundred and ninety is insane. The corridor, the pavilion, and the cottage systems were described with their advantages and disadvantages. The peculiarities of the American location of administration-rooms in the centre, with boiler-rooms at the rear was noticed. In the new asylums of Indiana the home or house feature is carried out to a greater extent than elsewhere. Three types were used in Indiana. The Northern Hospital at Logansport was patterned on the pavilion design. Each building is complete in itself. The Eastern Hospital at Richmond, is designed on the cottage principle, the home being as nearly copied as is possible. The Southern Hospital is more on the old corridor system, save that all wings are separated, instead of being joined at the center. The method of ventilation was described; water-closets are all placed outside the building, connected with it by corridors, preventing the entrance of foul air. The roof is of the well-known "slow-burning" construction.

An adjournment was had until 10 o'clock, Friday morning.

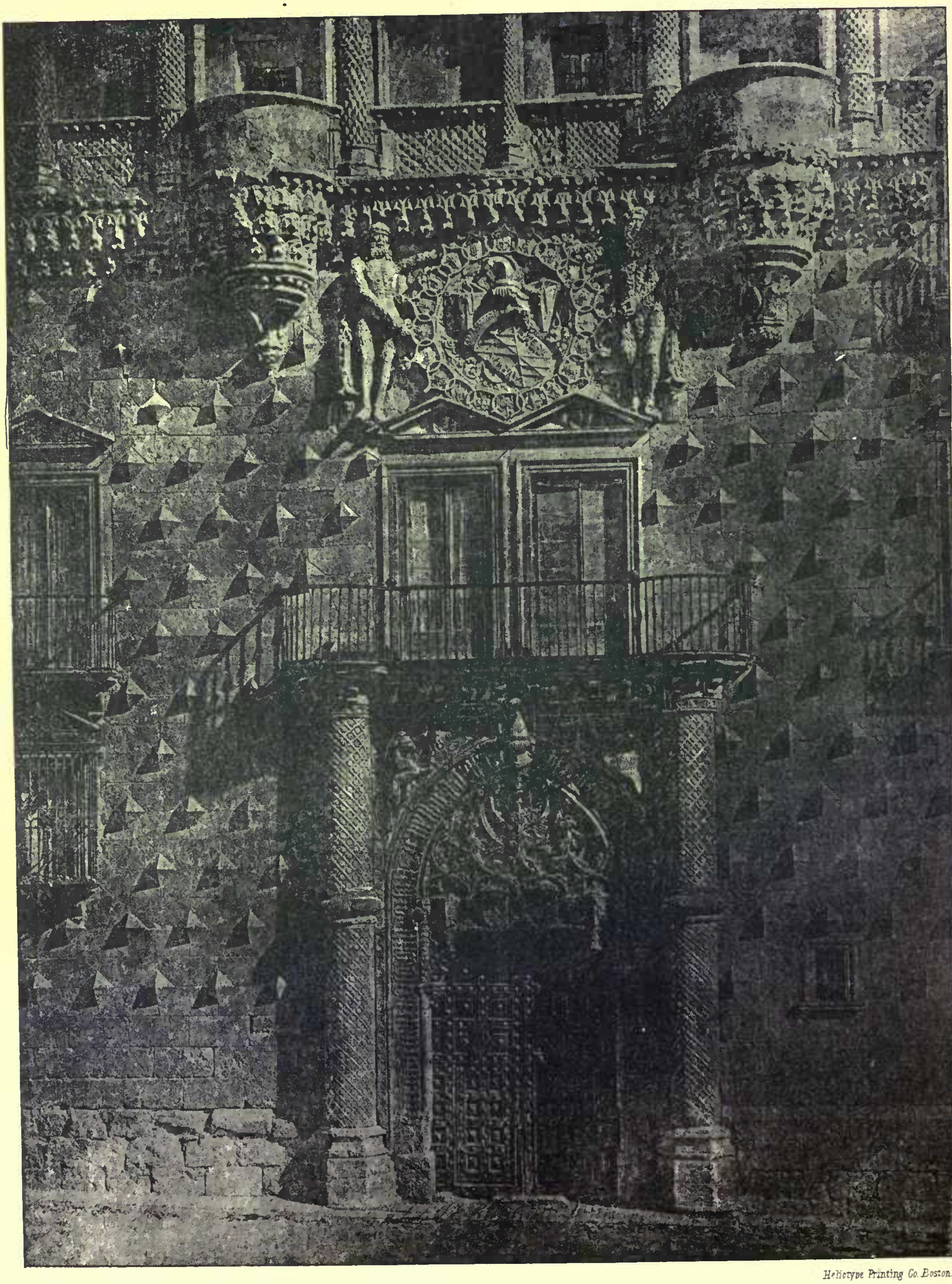
THIRD DAY.

At the opening of the session, Mr. N. S. Patton offered a resolution to the effect that the Association recommend the adoption of the metric system of weights and measures, and that the President appoint a committee of three, whose duty it shall be to correspond with other organizations interested in this subject, and in connection with them petition Congress to pass a law making the use of the metric system compulsory, after a reasonable period. It was carried.

Mr. John W. Root offered amendments to the constitution taking away the right of other organizations of architects to elect members to this Association, and making members, who, after three years' active and honorable practice in architecture leave the profession, honorary members. The amendments were carried.

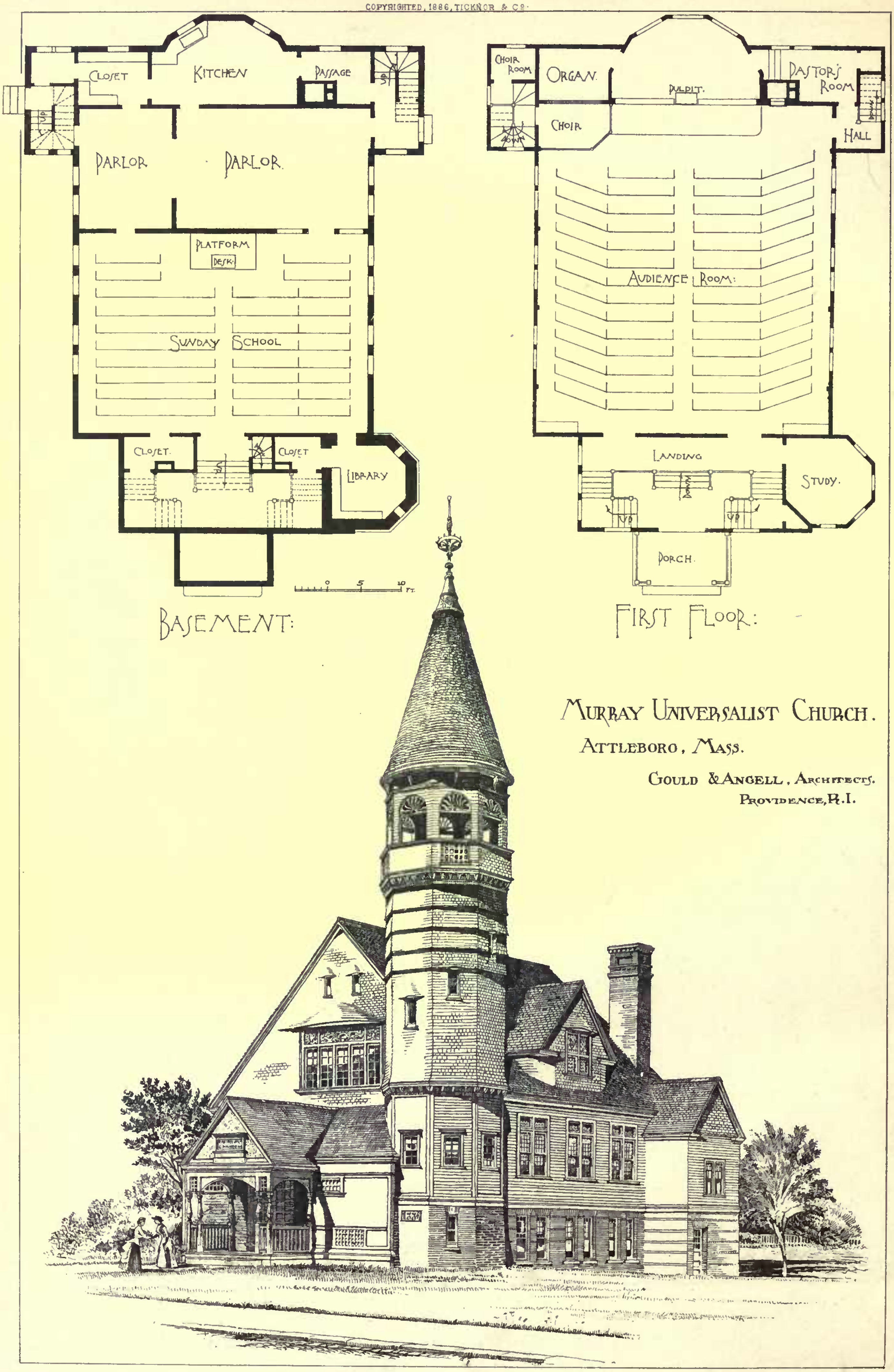


OLD COLONIAL WORK,



Heliotype Printing Co. Boston.

Palacio del Infantado, Guadalajara Spain.
Main Entrance.



MURRAY UNIVERSALIST CHURCH.

ATTLEBORO, MASS.

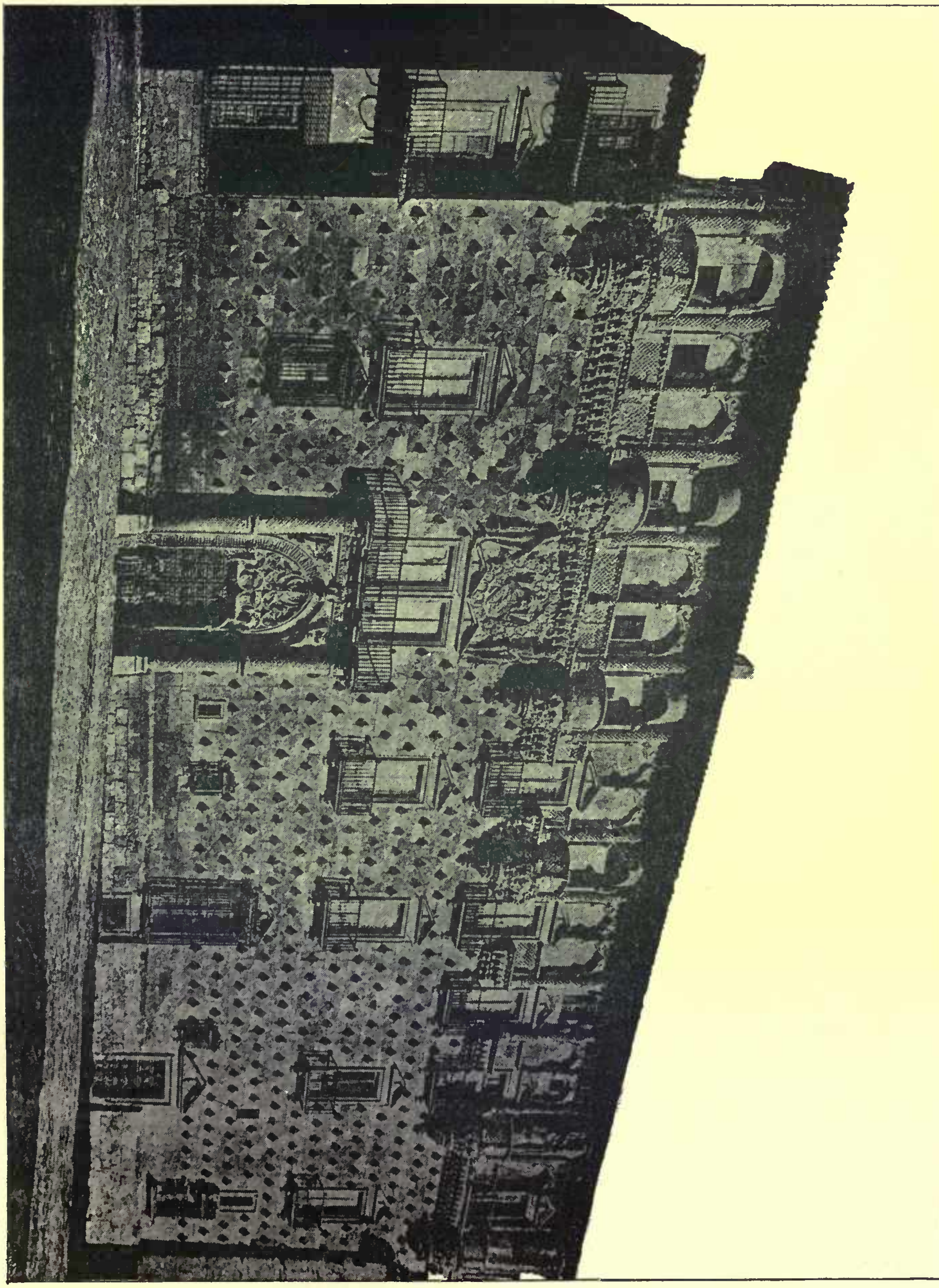
GOULD & ANGELL, ARCHITECTS.
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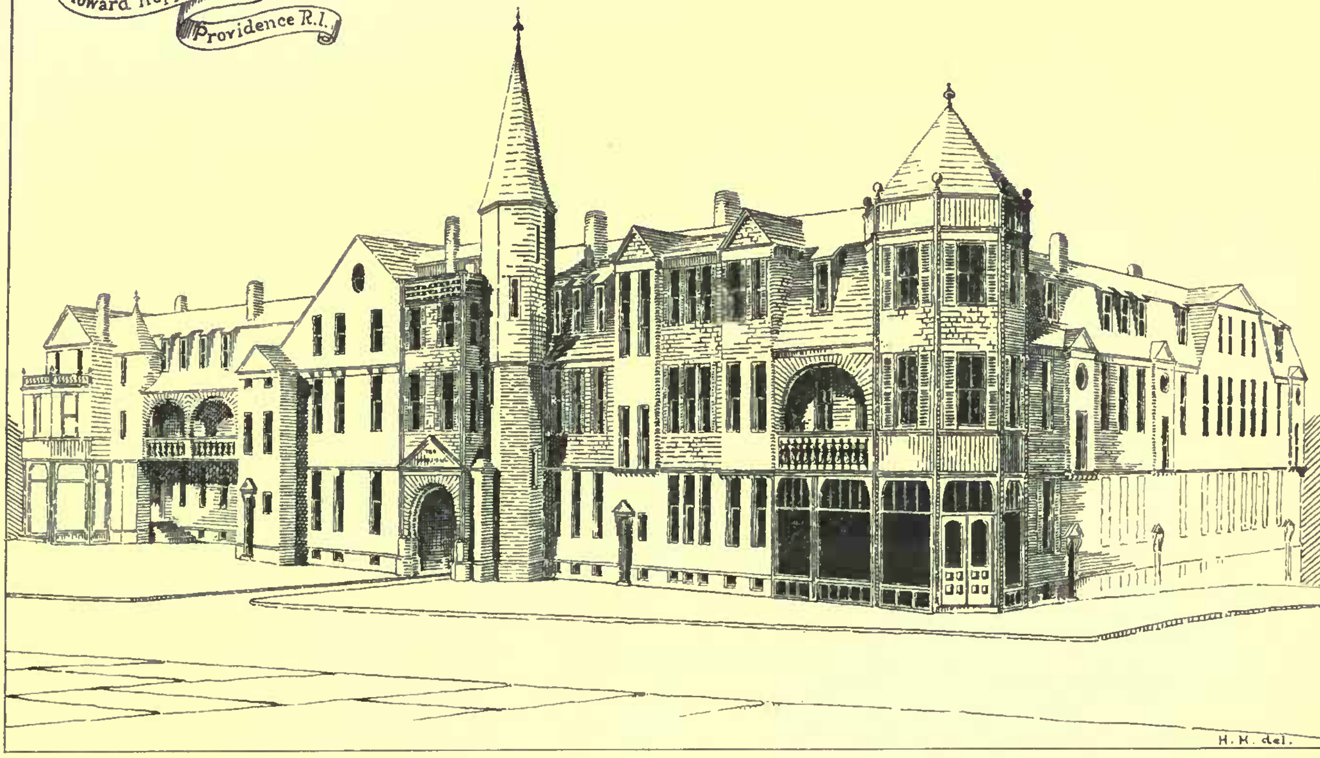
Palacio del Infantado, Guadalajara Spain.

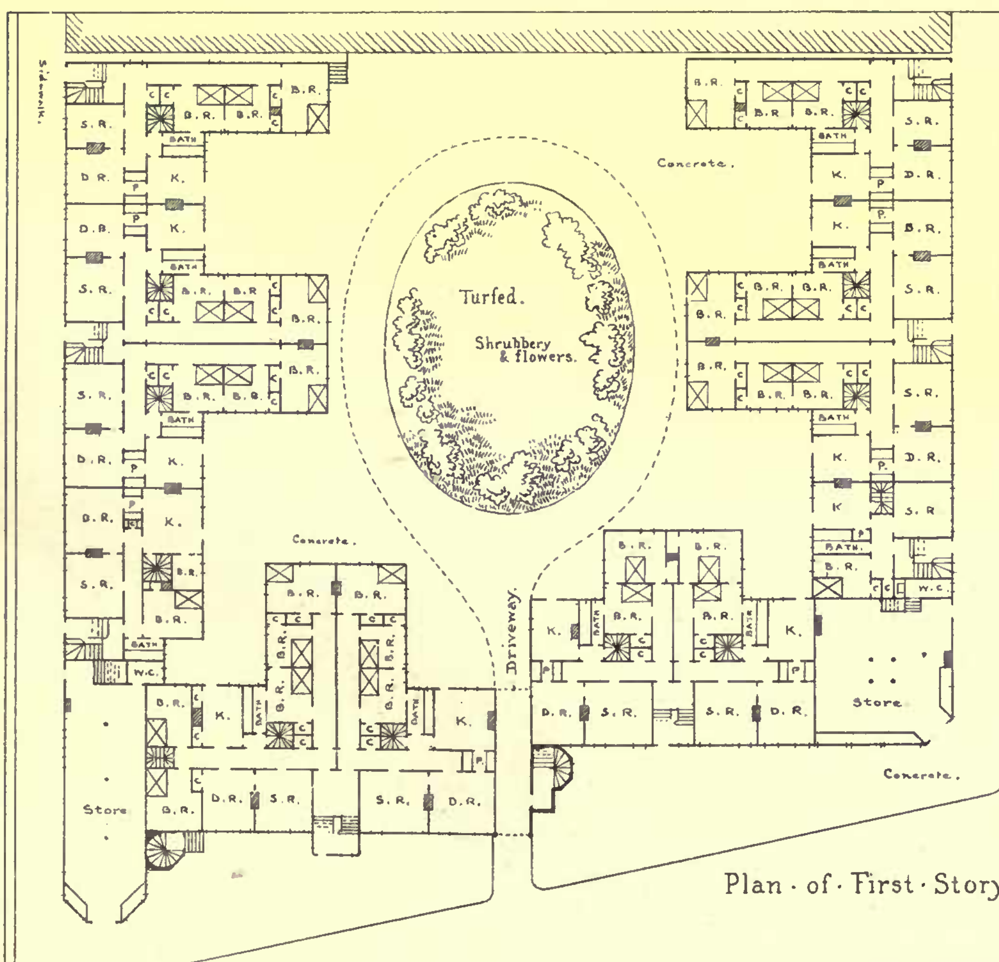
Heliotype Printing Co. Boston.

BLOCK·OF·APARTMENT·HOVSES for The Central Land Co., Providence R.I.

THE "WHITFIELD."

Howard Hoppin Arch't. Providence R.I.





Plan · of · First · Story.

BLOCK OF APARTMENT HOVSES for THE CENTRAL LAND CO. Providence R.I.

THE WHITFIELD

Howard Hoppin Arch't.
Prov. R.I.

Mr. Henry Lord Gay presented a petition from the "Technical Associated Press," asking the Association to do away with the system of "official organ" reports. A motion made by Mr. E. H. Ketcham to lay the petition on the table indefinitely, was almost unanimously defeated. Mr. Sidney Smith moved that the petition be received and freely discussed, which was carried. Mr. S. M. Randolph moved that the resolution appointing the *Inland Architect* the official organ be reconsidered, and it was carried. The question was discussed by C. E. Illsley, of St. Louis, who moved that the petition be referred to a committee. This was not seconded, and other remarks were made by Messrs. D. Adler, F. G. Corser, and C. C. Hellmers, the latter of whom moved that the committee be instructed to find the cost of publishing the proceedings in pamphlet form, and Messrs. Jno. W. Root, E. F. Fassett, Henry Lord Gay, Charles W. Crapsey, and B. P. Furber were appointed. Mr. Illsley's motion was then put and defeated.

Mr. Geo. W. Rapp, of Cincinnati, moved that the Association receive bids from two prominent Western journals for the privilege of publishing the reports.

Mr. S. A. Bullard, of Springfield, Ill., moved as a substitute that the proceedings be published in pamphlet form, and it prevailed. It was voted that at future conventions the Board of Directors be authorized to employ a stenographer to take down the proceedings.

On motion of Mr. Hellmers, it was voted that the names of applicants be sent to the Board of Directors, and their names be forwarded to each member thirty days before each convention.

Mr. Adler retired from the chair, and offered a motion that members of local architectural associations in States where no State association is organized, be admitted without dues; but it was referred to the Board of Directors for action.

Mr. C. E. Illsley presented a paper on "Sewer-Gas," and, on his own motion, it was not read, but ordered printed in the *Proceedings.*

The President read the reports of the two nominating committees. One committee reported: For place of next annual meeting, Chicago; for President, Sidney Smith, of Omaha; for Secretary, John W. Root, of Chicago; for Treasurer, Geo. W. Rapp, of Cincinnati; for Board of Directors, D. H. Burnham, Chairman, Chicago; Wm. Holabird, Chicago; C. L. Stiles, Chicago; G. M. Goodwin, Minneapolis; C. C. Hellmers, Jr., St. Louis.

The other committee reported: For place of next annual meeting, Cincinnati; for President, John W. Root, of Chicago; for Secretary, J. F. Alexander, La Fayette, Ind.; for Treasurer, S. A. Treat, Chicago; for Board of Directors, Geo. W. Rapp, Cincinnati; Chas. Crapsey, Cincinnati; G. M. Goodwin, St. Paul; D. Adler, Chicago; C. C. Hellmers, Jr., St. Louis.

Mr. Sidney Smith declined the honor of office, and moved that Mr. John W. Root be elected unanimously. He was so elected, (Cheers.)

The ballot for location resulted as follows: Cincinnati, 56; Chicago, 31; St. Paul, 4.

The ballot for Secretary resulted as follows: J. F. Alexander, 39; L. H. Sullivan, 35; and a few scattering.

Mr. Treat was then elected Treasurer.

The ballot for Board of Directors resulted in the election of the following gentlemen: George W. Rapp, Cincinnati; Charles Crapsey, Cincinnati; D. Adler, Chicago; G. M. Goodwin, Minneapolis; C. A. Curten, Louisville, Ky.

Messrs. W. W. Carlin, of Buffalo, and George W. Thompson, of Nashville, Tenn., were elected members.

Thanks were extended to the "*Technical Associated Press*" for daily reports furnished, and to the Illinois State Association of Architects for entertainment.

The Chairman, Mr. Adler, announced the following standing committees (as far as appointed) for 1887: —

Committee on Discipline: The Board of Directors of the Western Association.

Committee on Raising the Standard of Professional Requirements for Membership: L. H. Sullivan, Chicago; Isaac Hodgson, St. Louis; Geo. B. Ferry, Milwaukee.

Committee on the Adoption of the Metrical System: N. S. Patton, Chicago; T. B. Annan, St. Louis; Geo. B. Ferry, Milwaukee.

Committee on Uniform Contracts and Specifications: The Executive Boards of the Several State Associations, to report at the next session of the Western Association.

Committee to take charge of the Bill Governing the Office of Supervising Architect of the United States: D. Adler, Chicago; D. H. Burnham, Chicago; J. F. Alexander, La Fayette, Ind.

Committee on Procuring Architectural Drawings and Photographs for Exhibition at the next Convention of the Western Association: The members of the Committee on Formation of State Associations.

Committee on Collection of Statistics on Competitions: C. E. Illsley, St. Louis, Mo.; Sidney Smith, Omaha, Neb.; E. H. Taylor, Des Moines, Io.; G. W. Rapp, Cincinnati, O.; J. F. Alexander, La Fayette, Ind.

Committee to Represent the Western Association at the next Annual Convention of the American Institute: W. L. B. Jenney, Chicago, Ill.; J. F. Alexander, La Fayette, Ind.; Sidney Smith, Omaha, Neb.; J. G. Haskell, Topeka, Kans.; John W. Root, Chicago.

After inviting the members to another lunch at Kingsley's, on behalf of the Illinois State Architects' Association, the meeting was adjourned *sine die.*

The Illustrations

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

HOUSE ON DUDLEY STREET, ROXBURY, MASS.

[Gelatine Print issued only with the Imperial Edition.]

UNTIL within a very few years, this was one of the best preserved of the old houses of the first class that could be found in the neighborhood of Boston. It is now generally known as the Taylor house, and is still owned by the heirs of that family. It is said to have been built about 1790 by one of the Coolidges, but which member of the family it was we have been unable to ascertain. More than any house we know, hereabouts, this one has an air of dignity and open-handed hospitality that one is more apt to associate with Virginians than with the followers of the Puritans. The house still stands isolated in its own grounds, wherein can be traced the remains of the old-fashioned formal garden, with its snug border of box, and fantastically trimmed shrubs. At the right can be seen the barn, which is as typical as the house, and one end of the long row of carriage-houses and other dependencies, backing against which are spacious graperies.

THE WESTFIELD APARTMENT-HOUSES, PROVIDENCE, R. I. MR. HOWARD HOPPIN, ARCHITECT, PROVIDENCE, R. I.

THIS building comprises thirty-nine distinct apartments and two stores. Every apartment has a private front door from private front hall to staircase hall. Every apartment has range and boiler, sink, bath-tub and water-closet; hot and cold water in all kitchens and bath-rooms. Every sitting-room and every dining-room is on a street front. Every apartment has a separate cellar with window on a street front for coal, etc. All staircase halls, sitting-rooms, dining-rooms and bed-rooms are papered. All other walls have soapstone finish. The whole building, outside, is shingled above string-course over first-story windows. Clapboarded below. Shingles stained red. Clapboards and trimmings painted gray-green.

MANTELS IN THE OFFICE OF LAMB & RICH, ARCHITECTS, NEW YORK, N. Y., AND AT WAITT PLACE, BARNSTABLE, MASS. MEASURED AND DRAWN BY MR. F. E. WALLIS, BOSTON, MASS.

MURRAY UNIVERSALIST CHURCH, ATTLEBORO', MASS. MESSRS. GOULD & ANGELL, ARCHITECTS, PROVIDENCE, R. I.

COTTAGE FOR G. C. HAMMILL, ESQ., SARATOGA, N. Y. MR. H. LANGFORD WARREN, ARCHITECT, BOSTON, MASS.

PALACIO DEL INFANTADO, GUADALAJARA, SPAIN.

MAIN ENTRANCE OF THE SAME.

SAFE BUILDING.[1]—X.

THE ARCH.

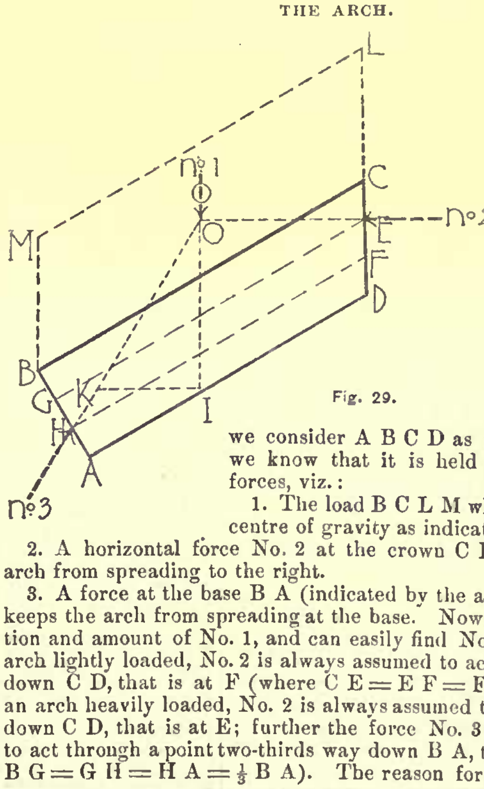


Fig. 29.

WE consider an arch as a truss with a succession of straight pieces; we can calculate it graphically the same as any other truss, only we will find that the absence of central or inner members (struts and ties) will force the line of pressure, as a rule, far away from the central axis. Thus, if in Fig. 29, we consider A B C D as a loaded half-arch, we know that it is held in place by three forces, viz.:

1. The load B C L M which acts through its centre of gravity as indicated by arrow No. 1.

2. A horizontal force No. 2 at the crown C D, which keeps the arch from spreading to the right.

3. A force at the base B A (indicated by the arrow No. 3), which keeps the arch from spreading at the base. Now we know the direction and amount of No. 1, and can easily find Nos. 2 and 3. In an arch lightly loaded, No. 2 is always assumed to act at two-thirds way down C D, that is at F (where $CE = EF = FD = \frac{1}{3} CD$). In an arch heavily loaded, No. 2 is always assumed to act one-third way down C D, that is at E; further the force No. 3 is always assumed to act through a point two-thirds way down B A, that is at H (where $BG = GH = HA = \frac{1}{3} BA$). The reason for these assumptions

[1] Continued from page 220, No. 567.

need not be gone into here. Therefore to find forces Nos. 2 and 3 proceed as follows: If the arch is heavily loaded, draw No. 2 horizontally through E (C E being equal to $\frac{1}{3}$ C D), prolong No 2 till it intersects No. 1 at O, then draw O H (H A being equal to $\frac{1}{3}$ B A), which gives the direction of the resistance No. 3. We now have the three forces acting on the arch concentrated at the point O, and can easily find the amounts of each by using the parallelogram of forces. Make O I vertical and (at any scale) equal to whole load (or No. 1), draw I K horizontally, till it intersects O H at K; then scale I K, and K O (at same scale as O I), which will give the amount of the forces Nos. 2 and 3. The line of pressure of this arch A B C D, is therefore not through the central axis, but along E O H (a curve drawn through E and H with the lines Nos. 2 and 3 as tangents is the real line of pressure.

Line of pressure not central.

Now let in Fig. 30, A B C E F D A represent a half-arch. We can examine A B C D same as before, and obtain I K = to force

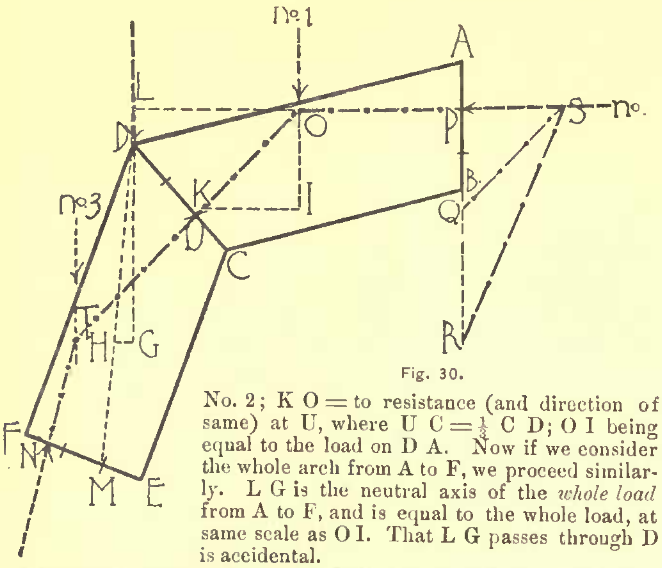


Fig. 30.

No. 2; K O = to resistance (and direction of same) at U, where U C = $\frac{1}{3}$ C D; O I being equal to the load on D A. Now if we consider the whole arch from A to F, we proceed similarly. L G is the neutral axis of the *whole load* from A to F, and is equal to the whole load, at same scale as O I. That L G passes through D is accidental.

Make E M = $\frac{1}{3}$ E F and draw L M; also G H horizontally till it intersects L M at H, then is G H the horizontal force or No. 2. We now have two different quantities for force No. 2, viz.: I K and G H, I K in this case being the larger. It is evident that if the whole half-arch is one homogeneous mass, that the greatest horizontal thrust of any one part, will be the horizontal thrust of the whole, we select therefore the larger force or I K as the amount of the horizontal thrust.

Now make S P = to I K and P Q = to No. 1, or load on A D and P R = to L G or whole load on F A, at any scale, then draw Q S and R S. Now at O we have the three forces concentrated, which act on the part of arch A B C D, viz.: Load No. 1 (= P Q), horizontal force No 2 (= S P) and resistance K O (= Q S). Now let No. 3 represent the vertical neutral axis of the part of whole load on F D, then prolong K O until it intersects No. 3 at T; then at T we have the three forces acting on the part of arch E C D F, viz.: The load No. 3 (= Q R), the thrust from A B C D, viz.: O T (= S Q), and the resistance N T (= R S). To obtain N T draw through T a line parallel to R S, of course R S giving not only the direction, but also the amount of the resistance N T. The line of pressure of this arch therefore passes along P O, O T, T N. A curve drawn through points P, U and N — (that is, where the former lines intersect the joints A B, D C, F E) — and with lines P O, O T and T N as tangents is the real line of pressure. Of course the more parts we divide the arch into, the more points and tangents will we have, and the nearer will our line of pressure approach the real curve.

Now if this line of pressure would always pass through the exact centre or axis of the arch, the compression on each joint would of course be uniformly spread over the whole joint, and the amount of this compression on each square-inch of the joint would be equal to the amount of (line of) pressure at said joint, divided by the area of the cross-section of the arch in square inches, but this rarely occurs, and as the position of the line of pressure varies from the central axis so will the strains on the cross section var y also.

Stress at intrados and extrados.

Let the line A B in all the following figures represent the section of any joint of an arch (the thickness of arch being overlooked) C D the amount and actual position of line of pressure at said joint and the small arrows the stress or resistance of arch at the joint.

We see then that when C D is in the centre of A B, Fig. 31, the stress is uniform, that is the joint is, uniformly compressed, the amount of compression being equal to the average as above. As the line of pressure C D approaches one side, Fig. 32, the amount of compression on that side increases, while on the further side it decreases, until the line of pressure C D, reaches one-third way, Fig. 33 (that is, D B = $\frac{1}{3}$ A B). Then we see there is no compression at A, but at B the compression is equal to just double the average as it was in Fig. 31. Now, as C D passes beyond the central third of A B, Fig. 34, the compression at the nearer side increases still further, while the further side begins to be subjected to stress in the opposite direction or tension, this action increasing of course the further C D is moved from the central third. This means that the edge of arch section at B would be subject to very severe crushing, while the other edge (at A) would tend to separate or open.

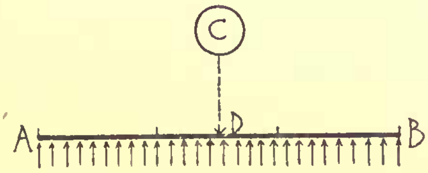


Fig. 31.

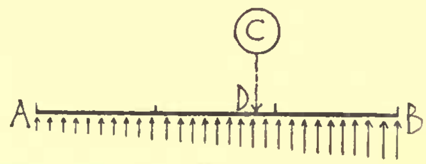


Fig. 32.

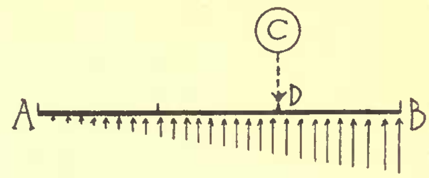


Fig. 33.

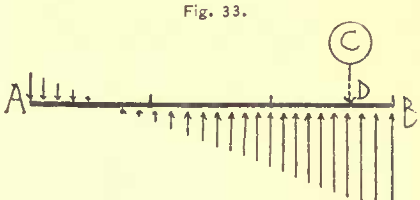


Fig. 34.

When the line C D passes on to the edge B, the nearer two-thirds of arch joint will be in compression, and the further third in tension. As the line passes out of joint, and further and further away from B, less and less of the joint is in compression, while more and more is in tension, until the line of pressure C D gets so far away from the joint finally, that one-half of the joint would be in tension, and the other half in compression.

Tension means that the joint is tending to open upwards, and as arches are manifestly more fit to resist crushing of the joints than opening, it becomes apparent why it is dangerous to have the line of pressure far from the central axis. Still, too severe crushing strains must be avoided also, and hence the desirability of trying to get the line of pressure into the inner third of arch ring, if possible.

But the fact of the line of pressure coming outside of the inner third of arch ring, or even entirely outside of the arch, does not necessarily mean that the arch is unstable; in these cases, however, we must calculate the exact strains on the extreme fibres of the joint at both the inner and outer edges of the arch (intrados and extrados), and see to it that these strains do not exceed the *safe* stress for the material.

The formulæ to be used, are:

For the edge fibres nearest to the line of pressure

$$V = \frac{x}{a} + 6 . \frac{x.p}{a.d} \qquad (44)$$

And for the edge fibres furthest from the line of pressure

$$V = \frac{x}{a} - 6 . \frac{x.p}{a.d} \qquad (45)$$

Where v = the stress in lbs., required to be exerted by the extreme edge fibres (at intrados and extrados).

Where x = the distance of line of pressure from centre of joint in inches.

GLOSSARY OF SYMBOLS. — The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.: —

a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
f = *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g_1 = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches. [See Table I.]
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right-hand re-action* (or support) of beams, in pounds.
r = *moment of resistance*, in inches. [See Table I.]
s = *strain*, in pounds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
$\mathfrak{d}$ = *diameter*, in inches.
$\mathfrak{r}$ = *radius*, in inches.
π = 3.14159, or, say, 3.1-7 signifies the *ratio of the circumference and diameter of a circle*.

If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_{I}, a_{II}, a_{III}, etc., or b, b_{I}, b_{II}, b_{III}, etc.

In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance: —

m = moment or bending moment at *centre*.
m_A = " " " *point A*.
m_B = " " " *point B*.
m_X = " " " *point X*.
s = strain at *centre*.
s_B = " *point B*.
s_X = " *point X*.
v = stress at *centre*.
v_D = " *point D*.
v_X = " *point X*.
w = load at *centre*.
w_A = " *point A*.

Where $a =$ the area of cross section of arch at the joint, in square inches.

Where $p =$ the total amount of pressure at the joint in lbs.

Where $d =$ the depth of arch ring at the joint in inches, measured from intrados to extrados.

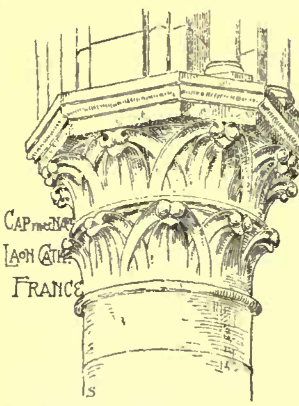
When the result of the formulæ (44) and (45) is a positive quantity the stress v should not exceed $\left(\frac{c}{f}\right)$, that is the safe compressive stress of the material. When, however, the result of the formula (45) yields a negative quantity, the stress v should not exceed $\left(\frac{t}{f}\right)$, that is the safe tensile stress of the material, or mortar.

The whole subject of arches will be treated much more fully later on in the chapter on arches.

LOUIS DECOPPET BERG.

[To be continued.]

THE SEPARATE SYSTEM OF SEWERAGE.[1]



TWO engineers, not long ago, had occasion to design and construct a system of sewerage for an important Eastern town. Like conscientious men, they studied the case thoroughly before laying out their plan, collecting and comparing all the information within their reach, and, as the result of their observations, devised a system of separate sewerage, which they carried into successful execution, and, as a supplement to their work, they formed the excellent idea of publishing an abridgement of the notes which they had gathered from a multitude of sources, for the benefit of other engineers and of the public. This task they did well, and their little book is not more remarkable for its fairness and moderation of statement in regard to points disputed in the profession than for its practical character, every detail of the most improved separate-sewer construction being described with a clearness and precision which particularly commend the work to general readers, and to non-professional persons, such as town and city authorities, who are obliged to decide upon many of the points considered, and who wish to be able to do so intelligently. The book begins with a succinct presentation of the well-known facts on which the necessity for sewers is based, fortifying its statements of the dangers of cesspool disposal of wastes by a number of new analyses of well-water, some of which are very striking. The analyses differ somewhat from those usually given, the combined ammonium appearing as organic nitrogen, and nitrites being reduced and added to the nitrates, while the proportion of chlorine, which is now known, in inland towns, to furnish the surest evidence of sewerage pollution, is given in a column next to the nitrate figures. According to the table, Schenectady, New York, appears to boast some of the worst well-water in the world. One sample, taken on the thirtieth of March, at the time when the ground is usually most thoroughly saturated with water, and impurities in wells are, therefore, most diluted, showed not only free and combined ammonia in extraordinary quantities, but more than three parts in one hundred thousand of nitrates, and nearly twenty-eight and one-half parts of chlorine. This specimen was taken from the water furnished to a typhoid-fever patient, who claimed that it was "the best water in the city." Another sample, nearly as rich as the last, was also taken by a physician from a well out of which had drunk three persons, all of whom had had severe illnesses, from which two had died; and it is remarkable that, after the physician in question had stopped the use of the well-water by a fourth patient whom he found very ill in the same house, she began immediately to improve, and from a condition of high fever, with pulse at 140, and temperature 105.5, accompanied by nausea and diarrhœa, she regained in two weeks nearly her usual health. It seems strange that intelligent persons should need books to warn them of the danger of drinking water from wells situated near privy vaults or cesspools, as were, of course, those from which all these highly-chlorinated samples were taken, yet the situation of the worst of the wells described was not so objectionable as that of one from which we were once urged, in vain, to drink some particularly delicious water, and there can be little doubt that the opinion of the most experienced health officers, that the majority of all the wells in use furnish water contaminated with ordure, is correct.

To the ordinary reader the connection between the condemnation of unwholesome wells and the introduction of sewers does not seem so close as it does to the engineer. It seems easy enough, if a well is shown to be impure, to dig another on higher ground, or at a safe distance; but sanitarians have long ago found out that, inasmuch as wells within a moderate distance of each other take their supply from the same slowly circulating stratum of ground water, any pollution detected in one is quite sure to be sooner or later shared by the others, while, in point of fact, nothing short of a severe surveillance could prevent people from drinking out of the polluted wells, in spite of the danger, if it happened to be a little cheaper or less troublesome to get their supply from them than from some better source. Some persons, not acquainted with such matters, may resent this statement as casting an unmerited imputation on the popular common sense, but the fact that it was seriously proposed, not long ago, to supply the tenants in the Western Union Telegraph building on Broadway, in New York, with drinking water from an artesian well sunk in the cellar of the building, in a loose, gravelly soil, which in that region is so honeycombed with old cesspools that we have ourselves known more than fifty to be exposed in excavating for a cellar about one hundred and fifty feet square, is evidence enough that people of considerable intelligence are not always on their guard against evils, which, if they thought about them, they would regard with sufficient apprehension; and the only safe course is, as long experience has proved, to separate, totally and permanently, the water which comes into a house from that which runs out of it. Whether this is best done by mixing the house-wastes with the rain-water which falls on the roofs, pavements, streets and lawns, and letting the whole flow away together, or by keeping the house-wastes separate, in small pipes, and providing for its safe removal independent of that of rain-water, is a question of detail in sewerage, but this detail is now becoming the most important one connected with the subject, except, perhaps, that of the final disposition of the waste material.

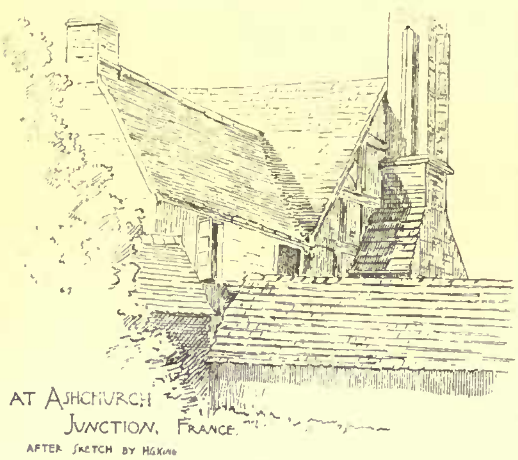
It is hardly necessary to say that our authors, like all who approach the subject of drainage from its sanitary side, favor very strongly the removal of the house-wastes by themselves, in small glazed pipes, so arranged as to secure the rapid transfer of all refuse liquids, before they have time to putrefy, to a place of safety, leaving storm-waters to be carried away to the rivers or elsewhere, either by paved or grassed gutters, or, in the case of densely-populated cities, by a system of pipes appropriated to that object, and serving also, perhaps, to drain the subsoil by some provision for admitting ground-water. The objection usually urged against the separate system of sewerage is the increased expense, the argument being that as ordinary sewers, to carry off the water of even a moderate rainfall, must be made so large that the addition of house-wastes does not necessitate any increase in the size of the pipes, the construction of a separate system of pipe for conveying house-wastes alone is a work of supererogation, to use the only English word which expresses the necessary idea; and the cost of the system of small pipes, in a growing town, had better be saved to go towards paying for the larger pipes which will some time be necessary, and will accommodate all the sewage as well as the storm-water. There is good sense in this reasoning, so much, in fact, that thousands of lives are probably sacrificed every year to vindicate it, and in the discussion of the problem of sewerage, which is already a very pressing one for scores of small towns and cities, it should be fairly faced. If our streets were kept like these of a French town, it would be easy to say that the question was not between street-drains with or without provision for carrying sewage, but between the small-pipe sewerage system and that of cesspools and privies, and we should look with horror on the idea of admitting sewage to the clear streams of surface-water which we conducted, after storms, into the natural water-courses; but with our streets as they now are, the washings from the most frequented of them are as foul as any sewage, and could not be allowed to flow in open channels without annoyance, and perhaps danger; so that we are brought back to the premises from which we started, that, as we shall have dirty water flowing through our street-drains in any case, when we get them, and as the addition of two per cent in the form of house-wastes will not require any increase in the size of the drains, it is wasteful to spend the money which might be saved for street-drains in laying small pipes to carry house-wastes alone; and these considerations appear to many town governments unanswerable.

It is quite time that, in the interest of the public health, the reply to this reasoning should be generally known. The question for most of our small cities is not whether present expenditure shall be avoided to save money for future possible needs, but whether the system now in use may not at once be advantageously replaced by another, leaving this to be replaced by a third, ten, twenty, or fifty years hence, if it shall then be necessary to make the change. As between the advantage of a system of small-pipe sewers, with the safe, quick and cheap removal of refuse liquid, and those of a system of cesspools and privies, costly to clean, dangerous to those who own them, as well as to their neighbors, and slowly, but surely destructive, by the incurable pollution of the ground, of the healthfulness and good name of the community in which they are allowed to exist, there can be no difference of opinion; and it ought to be clearly understood that from the moment when the money value of the lives annually lost in any town by preventable zymotic diseases, added to the expense of cleaning cesspools and privies, and the interest on their cost, reaches the amount of the annual interest on the cost of a sewerage system for removing the wastes which the cesspools and privies have been receiving, any delay in providing such a sewerage system is not an economy, but a direct loss in money to the community, which increases at compound interest from year to year. According to Messrs. Staley and Pierson's tables, the expense of a complete set of sewers for house-wastes only, as shown by the experience of Memphis, Keene, and other places, varies from seventy-two cents per lineal foot, which was the cost at Schenectady,

[1] "*The Separate System of Sewerage.*" Its Theory and Construction. By Cady Staley, President of the School of Applied Science, Cleveland, Ohio, and Geo. S. Pierson, C. E. New York: D. Van Nostrand, 23 Murray Street. 1886.

to one dollar and forty-six cents per foot at Memphis, which, however, included the expense of subsoil-drains laid in the same trench; and the cost of maintenance is about one-fourth of one per cent on the cost per annum. To apply this roughly to the conditions which exist in hundreds of towns, we will suppose that the inhabitants of the more thickly-settled part of a small city are considering the subject of putting in sewers for themselves, at their own expense. There are about four miles of streets in the portion which it is proposed to provide with sewers, or nearly twenty thousand feet, and the house-lots fronting on them average, including the allowance for the vacant lots, two hundred feet in width. This will give two hundred houses, counting both sides of the streets, each with a privy and a cesspool. Supposing that it is necessary to go two miles beyond the most remote end of the sewered district to get a proper outfall for the sewers, we shall have approximately thirty thousand feet of sewer, which, at a dollar a foot, will cost thirty thousand dollars, and will need an outlay of one hundred and fifty dollars a year for maintenance, which we will call the interest on thirty-seven hundred and fifty dollars, and add this, as capital, to the cost of the sewers, making the whole capitalization thirty-three thousand seven hundred and fifty dollars. On the other side of the balance sheet we find the cost of two hundred cesspools and an equal number of privy vaults, which may be set down at seventy-five dollars for each house, or fifteen thousand dollars in all. The annual cost of cleaning each cesspool, including a sinking-fund for renewal when it becomes hopelessly clogged, would not be less, taking the average of our well-to-do cities, than twelve dollars, and the annual cleaning of a privy costs about five dollars more. This gives us, for maintenance of cesspool and privy, seventeen dollars a year for each house, or thirty-four hundred dollars in all, which, capitalized as before at four per cent, gives eighty-five thousand dollars. Adding this to the original outlay for the cesspools and privies, we find the total capitalization of the filthy old system, or the actual cost, reduced to one payment, to be exactly one hundred thousand dollars, leaving a profit to be added to the sewerage side of the balance sheet of sixty-six thousand two hundred and fifty dollars. We might well open another account with indirect expenses incident to the old system, to include income lost through attacks of diphtheria, pneumonia, sore throat, typhoid fever, consumptive ailments, colds, agues, diarrhœas, dysenteries, rheumatism and general debility, directly occasioned by foul air and saturation of the soil, together with the cost of medical attendance and funerals, but this, although a calculable and very large quantity, need not here be considered, the other figures being sufficient to show the financial folly, even in a community of immortal beings, exempt from aches and pains, of delaying for a moment, under the conditions which obtain in the more closely settled part of most towns of ten thousand inhabitants, the substitution of small-pipe sewers for the barbarous, filthy and extravagantly costly devices which, in practice, deplete our pockets while they fill our homes with sickness and mourning.

RUSSIAN RULES FOR THE USE OF STEEL IN CONSTRUCTION.



AT ASHCHURCH JUNCTION, FRANCE. AFTER SKETCH BY H.G.KING

THE Russian Ministry of Roads has published a series of provisional regulations concerning the use of steel, of which the following is a summary:

1. Steel, whether Bessemer or Siemens-Martin, may be used in all structures.

2. In view of the great sensitiveness of steel to mechanical working, it is to be noted that —

(*a.*) Plates and other sections must be tempered, after rolling, by means of the sand-bath. Care must be taken that on leaving the rolls the metal is not below a cherry-red heat.

(*b.*) Holes must not be punched, but drilled.

(*c.*) When worked cold, the material must not be sheared, but cut with a chisel. The edges must be planed. All boring must be done hot, and provision be made for subsequent slow cooling.

3. The material must possess the following properties:

(*a.*) It must contain from 0.05 to 0.20 per cent of carbon.

(*b.*) Except for rivets, the tensile strength of all kinds of steel must be from 25.4 to 29.8 tons per square inch, extension at least 18 per cent, and the contraction of area at least 36 per cent.

For rivets, the tensile strength must be from 22.2 to 25.4 tons per square inch, extension at least 20 per cent, and contraction of area at least 50 per cent. The percentage of carbon for rivets must approach the lower limit (see *a*). Extension and contraction of area are to be measured on test pieces of 10 inches in length. The test pieces must be worked cold.

4. A strip of the metal 10 or 12 inches in length, heated to cherry-red, and then plunged into water at 85½ degrees Fahrenheit, must not show any cracks when so bent that the inner faces of the bent piece, at a distance from the angle of one-and-a-half times the thickness of the plate, are three times the thickness of the plate apart.

5. The permissible strain upon the material is as follows:

(*a.*) For bridges of less than 49-foot span, and also for roadway-bearers (longitudinal and cross):

	Tons per square inch. Steel.	Iron.
For tension and compression,	4.4	3.8
Shearing of rivets, fastening the longitudinal to the cross-bearers, and these to the main girders,	3.8	3.2
Shearing of rivets in the rest of the structure,	4.4	3.8
Shearing of the web of a plate-girder,	2.9	2.2

(*b.*) For main girders of bridges of from 49 to 95 foot span:

	Steel.	Iron.
Compression (after deducting half area of rivet holes),	4.8	4.4
For tension (net cross-section, after deducting rivet-holes),	4.8	4.4
Shearing of rivets,	4.4	3.8

(*c.*) For main girders of bridges of more than 95-foot span:

	Steel.	Iron.
Tension (net cross-section, after deducting rivet-holes),	5.1	4.6
Compression (after deducting half area of rivet-holes),	5.1	4.6
Shearing of rivets,	4.4	3.8

(*d.*) For wind-bracing of bridges of more than 95-foot span:

	Steel.	Iron.
Tension (net cross-section),	6.3	5.7
Compression (after deducting half area of rivet-holes),	5.7	5.7
Shearing of rivets,	5.1	4.8

Iron and steel may be used in the same structure, but with the limitation that in each member of a group of similar parts the same material is to be used. For instance, the top and bottom booms of a girder form such a group; the diagonals and verticals of a girder, the cross and longitudinal roadway-bearers, are other such groups. The use of steel rivets is not compulsory with steel plates. — *Iron.*

SOCIETIES

BUFFALO ARCHITECTURAL SKETCH CLUB.

THE Buffalo Architectural Sketch Club was organized last week at the office of W. W. Carlin, 57 Chapin Block, with twenty-five members. Meetings will be held on the second and fourth Wednesdays of every month. The following officers were elected: President, F. R. Fuller; first vice-president, F. C. Townsend; second vice-president, William Lansing; secretary, J. S. Rowe; treasurer, F. W. Fisher. J. S. Rowe, *Secretary.*

COMMUNICATIONS

STEEL PLATES AND THE OREGON.

PROVIDENCE, R. I., November 22, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In your No. 534, of March 20, 1886, you suggested that the loss of the "*Oregon*" might be attributed to her having been built of mild steel, when some of its characteristic qualities were less well known than at present. You refer again to the "*Oregon*" in No. 569, of last Saturday, in an article on the different steels and iron, and I suppose classing her as of steel.

I thought your theory a most excellent one, until I chanced to see, in a "*History of the Cunard Steamship Company*," issued by that company, that the "*Oregon*" was described as an "*iron* screw steamship," the only steel ships of that company being the four at present running to New York. Very truly, B.

[THE "*Oregon*" is described, we believe, in "*Lloyd's Register*," as well as in the "*History of the Cunard Steamship Company*," as being of iron, but at the time of the accident to it the plates were many times spoken of as being of steel, and we have never seen any authoritative denial of this. — EDS. AMERICAN ARCHITECT.]

AN UNHAPPY — YET HAPPY — BLUNDER.

ROYAL INSTITUTE OF BRITISH ARCHITECTS,
9 CONDUIT ST., HANOVER SQUARE,
LONDON, W., November 12, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In your issue of the 30th ult., you announce the death of Mr. George Godwin, F. R. S. Permit me to inform you and your readers that, happily, we have not to deplore this gentleman's decease. Your informant has evidently confused the two architects, George Godwin and the late E. W. Godwin. Mr. George Godwin, although he has had but indifferent health for many years, is still active in his work for others; and so late as Wednesday last was engaged, with his accustomed mental vigor, at a meeting of the Royal Literary Fund, with which society, among various others, he has been connected for many years. I have the honor to be, sir,

Yours, etc., HERON B. VERITY.

MILL-FLOORS IN BOSTON.

BOSTON, MASS., November 23, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, —Does not Mr. Atkinson prove by his own figures that the average safe load per square foot, sustained by regular mill construction of the three floors he has assumed would be about twenty-five per cent less than by the system using longitudinal girders? Also that the latter system saves about six per cent in weight of floor, while gaining the twenty-five per cent in strength? Leaving out the question of increased combustibility, it would seem that a total gain of over twenty-five per cent in strength of a floor was a very substantial reason for employment of system he questions.

Using a factor of safety of 3, as required by City Building Act, and assuming ordinary load on floors of commercial buildings as 200 lbs. per square foot, though authorities say it may run as high as 400 lbs. in some cases, it would seem to be desirable, in view of increased strength of floor, to use a longitudinal girder, if the increased combustibility is not a too serious objection. I remain,

Yours sincerely, W. WHITNEY LEWIS.

VENTILATING ROOF-SPACES.

CHICAGO, November 22, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — If the space between roof and ceiling is ventilated, as you recommend in your last issue, what will be the effect in winter if the ventilating openings are not closed? Such openings are often made where they are inaccessible, or where they are likely to be forgotten. If they are left open during cold weather, will not the upper rooms be chilled more than with a tight roof? Would it not be a better plan to close the air-space tightly and keep out the heat and cold alike by a thicker or more non-conducting roof?

Very truly yours, N. S. P.

[OUR correspondent's suggestion is well worth keeping in mind. We have, however, with the same idea, arranged for ventilating the roof-space as described, with movable shutters to close the openings in winter, but found that they were not used, and the air at the top of any warmed room in winter is so much hotter than elsewhere that the vicinity of the moving sheet of cold air would probably be little felt. No doubt, as Mr. Patton says, the best way of all is to put on a thick, non-conducting roof, of heavy plank or masonry, and the air-space under it, if any exists, will then need no ventilation beyond that required to keep the timbers from rotting. — EDS. AMERICAN ARCHITECT.]

THE BEST AND SAFEST MORTAR.

NEW YORK, November 29, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — Will you give me by mail the benefit of your advice as to the best and safest mortar to use in setting a limestone (say similar to Bedford stone), and also the best *pointing* mortar to use.

By "best and safest" I mean a mortar that is good and durable, and that cannot possibly stain the stone. I have been told that Lime of Teil makes the best pointing mortar for such a stone, and good ordinary lime mortar for setting. If you agree to this, what would you recommend as the best proportions for mixing it?

Very respectfully, ALEX DOYLE.

[WE know very little about the matter, and hope our readers may be willing to help us with some information. Lime of Teil seems disposed to effloresce, as we have seen it, almost as badly as ordinary cement, but this tendency might perhaps be checked by adding a little oil or soap. Selenitic cement is of a good color, and might do well. — EDS. AMERICAN ARCHITECT.]

INELIGIBLE FOR MEMBERS OF ARCHITECTURAL ASSOCIATIONS.

TERRE HAUTE, IND., November 22, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — Please answer the following in your paper: Is it proper that contractors for labor and materials, agents for the sale of iron-fences, tin-shingles, press-bricks, chimney-pots, hot-air furnaces, and such, styling themselves architects besides, should become members of the Western Association, and fellows of the American Institute? Respectfully, SUBSCRIBER.

[WE consider the action taken by the Western Association of Architects early in the second day of its session, as reported elsewhere, a sufficient answer to this question. — EDS. AMERICAN ARCHITECT.]

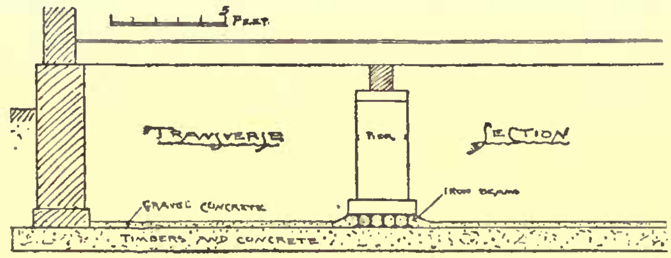
FOUNDATIONS IN COMPRESSIBLE SOILS.

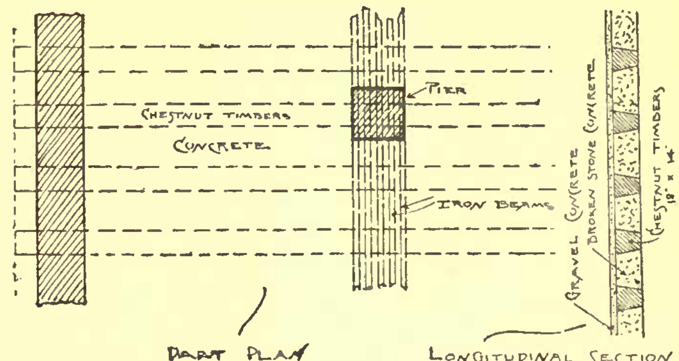
BRIDGEPORT, CONN., November 22, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — Having a controversy with an engineer, as to the merits of a system for putting in foundations for a certain building, I send herewith sketches illustrating the same to you, and beg that you will consider it, and through the columns of your valuable journal give your opinion upon it.

The building is designed for a warehouse, and is about fifty by thirty feet, three stories in height. It is to be erected on made ground, over what once was the bed of the harbor. There are a few feet of filling below the level of the cellar bottom, and below that the old bed of mud is many feet deep. This bed, however, has doubtless become somewhat solidified, by the heavy traffic of railroad trains over it for a number of years; the site being formerly occupied by railroad tracks. The proprietors will not pile, owing to the expense of it.





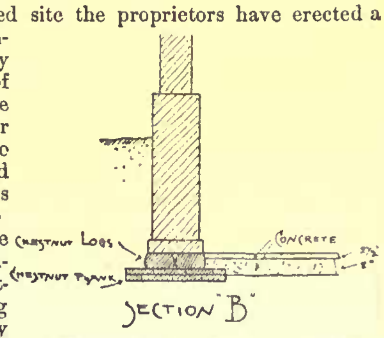
The sketches will show the system in question. Heavy chestnut timbers, sawed tapering, as shown, are first laid down, extending entirely across building, and one foot beyond outer line of cellar wall; any head-joints to be at middle of building.

The spaces between timbers are *at once* filled in with strongest broken-stone concrete, made with Portland cement, and well rammed. The walls are then built as shown. In the centre of building is a line of piers. The iron beams are laid down, extending under end walls, and the piers built upon them.

The obvious purpose of the scheme is to make the cellar-bottom a constructional part of the building, and, by making it strong enough to resist any transverse strain put upon it by a tendency of the walls or piers to settle, to prevent such settlement, unless all settles together. The timbers being built through the wall must settle with the wall (the heavy footing stones extend from timber to timber), and the timbers cannot settle without carrying with them the concrete arches. The iron beams distribute the weight from the piers over the beams and concrete arches.

The building is close by the edge of the harbor, and the cellar bottom is from three to four feet below high water; so the chestnut beams would always be wet.

Not far from the proposed site the proprietors have erected a building upon a plank and timber foundation, as shown by "Section B." Two layers of two-inch chestnut planks were laid down, crossing each other diagonally; upon these, two heavy chestnut logs were placed longitudinally, and the walls built upon them. What do you consider the comparative advantages of these two foundations? And which the better? By kindly answering these questions you will greatly oblige, Yours sincerely, JOS. W. NORTHROP, Architect.



[WE could hardly venture an opinion as to the comparative merits of the two designs for the foundation mentioned, without knowing more about the resistance of the ground under all parts of the proposed building. It may well be that the mud on which the building is to rest is so soft, and of so uniform a consistency as to make it advisable to resort to so costly a construction as that first described, which seems well calculated for use in a very soft and uniform ground. If, however, there were any doubt of the uniform consistency of the subsoil, or if the resistance seemed such as to make it probable that the weight could be sustained on a comparatively small area, and without any danger of lateral movement of the foundations, we should be inclined to make several careful tests of the bottom of the trenches, by loading a given area until a level, from a neighboring fixed bench-mark, showed settlement, and then see if, by proportioning the known weights on the walls and piers to the ascertained resistance of the soil, the necessary spread of the foundations could not be obtained by means of such planking as shown in Section "B," without making the planking so wide that it would bend under the effect of the opposite forces of the load upon it and the reaction of the soil. This seems to be one of the many cases where knowledge and care, such as our correspondent seems to desire to expend upon the problem, are worth many dollars to the owner of the building, and although the latter may be a little impatient at first that his architect cannot solve the difficulty by happy inspiration instead of hard work, he will soon come to appreciate the advantage of having his property dealt with by one who proposes to know what he is about before he makes his decisions. — EDS. AMERICAN ARCHITECT.]

NOTES & CLIPPINGS

CREMATION BY ELECTRICITY.— A movement has been set on foot in Italy toward erecting, in one of the principal towns, an electrical crematorium. In this edifice the corpses will be instantly consumed by means of an intense heat caused by electricity. Various European cremation societies are reported to have despatched representatives to Italy to make inquiries as to the feasibility of the scheme, which it is expected will, if successful, very soon replace the more elaborate methods now generally adopted. Partisans of cremation are sanguine that the introduction of electricity would instantly remove the objections held by many European States against the burning of bodies. Dogs — we presume dead dogs — have already been subjected to the process by its inventor with a considerable degree of success. Their bodies forthwith evaporated into nothingness, and there was perceptible none of that disagreeable odor of burning flesh which inhabitants of Woking are said so greatly to resent. — *Pall Mall Gazette.*

BIG UNDERTAKINGS. — Nothing seems too big for the present age, for we are continually being startled with something new and something immense, which has either been just completed, or is about to be carried out, or, at any rate, is projected or proposed. Within the last few weeks three new schemes have been either commenced or suggested in Switzerland, Greece, and Canada. The first-named scheme in Switzerland is proposed by an Italian engineer named Agudio, of Milan, for making a way through the Simplon, which he declares he can do by a tunnel of only 6,050 metres, the traction and haulage being done by hydraulic power. He says that, by this means, from 3,000 to 4,000 tons of goods could be safely transported without any breaking-up or trans-shipment of trains; while the cost of the whole proceeding would be only 28,000,000 francs.

Number 2 project consists of the bold but practical scheme of draining the Lake of Copaïs, near Thebes, in Bœotia, by which an area of a hundred square miles will be added to the territory of Greece. The acquiring of so very large a piece of land, which may be put to useful purposes, though undoubtedly one of vast importance, is not the only object intended to be effected by the proposal — the other being the destruction of one of the greatest fever-producing places in the country by reason of the pestilential malaria always arising from the waters of this lake. This alone would be an unspeakable blessing to the country round, and money should be readily forthcoming for the carrying out of so beneficial an undertaking. The rivers now flowing into the lake would be employed for irrigation and other purposes of practical utility.

Number 3 project proposes to connect Prince Edward Island with the Canadian mainland by means of a submarine railway tunnel, by which all communication can be kept open with the inhabitants of the island during the winter, a circumstance at present almost impossible, from the terribly rigorous nature of the winter climate of Canada; but Canada is bound legally to do everything that is possible to keep open a communication with this island at all times and by all means, for the accommodation and assistance of 125,000 persons who constitute the present population. The distance of the island is only six miles and a half, and the bed of the Northumberland Straits, under which the railway will be carried, presents no very apparent difficulties. The depth of water is, on the island side, 36 feet; and 10 feet 6 inches on the New Brunswick side; and about 80 feet in the middle. The tunnel will be 18 feet in diameter, and will be made of "chilled white cast-iron," in sections, these latter being bolted together with inside flanges, exactly in the same way in which the little tunnel for foot passengers under the Thames, and known as the "Tower Subway," was constructed some years ago. The cost of this undertaking is estimated at about 1,000,000 sterling. It has been well considered and highly commended, and will be brought before the Canadian Parliament very speedily, when the scheme will, no doubt, be fully sanctioned, as it has many warm supporters in the Legislative Assembly. Canada will, therefore, have her "submarine railway" long before her illustrious "mother" on this side of the Atlantic. — *Chambers' Journal*

TRADE SURVEYS

FROM a somewhat extended intercourse, both personal and by correspondence with a number of leading contractors and builders throughout the United States concerning the probabilities for 1887, from a railroad, manufacturing and building stand-point, we are safe in making the general statement that the coming year will be a much better year for all of the great interests than the present year has been. At the same time there is a difference of opinion felt and expressed which is deserving of recognition and which ought to enter into the conclusions. Most of those who feel entitled to speak upon these great questions take a sanguine view, and predict great activity. There are some who, remembering the sudden disasters that have befallen us in recent years, are inclined to advise prudence and a conservative course generally. The greatest danger the industries, in the general sense, have to face is the possibility of increasing capacity too rapidly, or building too rapidly, or of permitting too rapid an absorption of capital. The main point to be kept in view all agree is the maintenance of a healthy consumptive capacity both at home and abroad. The most encouraging feature is the multitude of engineering and industrial enterprises at home and abroad. Canals and tunnels are projected which will employ a great deal of capital and labor. The Panama Canal will be pushed with all possible despatch. Tunnels are projected in European countries, and are talked of in the United States, which, no doubt, will be shortly undertaken. Extensive terminal facilities are talked of by railroad companies, in addition to their enormous extensions for which arrangements have already been very largely made. All of the trunk lines contemplate expending a great deal of money next year. The Pennsylvania Company, to illustrate, proposes, besides building several hundred miles of new roads, to elevate its tracks in Jersey City, and to perfect its intricate system in many directions, which will involve a very large expenditure. The Baltimore and Ohio has enormous projects on hand which will call for the outlay of a great deal of money. It would be useless to endeavor to follow out the many projects of the leading and smaller corporations in the country. What they contemplate doing and will do will result in the opening up of a great deal of new territory, timber, mining and agricultural, and will create opportunities for building enterprises upon a large scale. Another very important movement in progress is the purchasing of large tracts of land in the South. This has been referred to before. During the past four or five weeks additional purchases have been made. Manufacturing companies have been organized, existing companies have extended their capital, and there seems to be a general outburst of enterprise among investors and capitalists and manufacturers both North and South to secure desirable locations. Within the past thirty days between ten and twelve million dollars' worth of industrial capital have been either invested or schemes have been perfected for its future investments. In Georgia, and even in Mississippi, companies are now perfecting plans for industrial enterprises, and in Tennessee a great deal of foreign and home capital has been invested in iron, timber, and fuel possibilities. A great deal of building will be done in that State during the next year. Railroad building will, of course, take the lead. The erection of manufacturing establishments will follow. Builders in Nashville, Chattanooga, and Birmingham are the authority for the statement that in those three centres alone the building that will probably be done next year will exceed in quantity the building done during the past two years. Memphis, Louisville, Atlanta, Augusta and some other Southern cities, are also promised a great revival in building, and the anticipations seem to be well justified by the well-authenticated statements of heavy investments of capital in these centres. There is, also, a little revival in the Southwest, but less is known of it because of the wider domain over which the enterprises extend, and the lesser inducements that are offered to industrial and building capital to operate in that region. Still, a spirit of enterprise has broken loose and a great deal of land has been purchased. The same is true of the mining regions of New and Old Mexico. In St. Louis where more is known of the resources of those localities than elsewhere, an immense amount of capital has been invested in mines by way of exploration, and investments in material and labor for the operation of mines. Of late years capitalists at home and abroad have lost much faith in American mining enterprises, but the confidence which St. Louis investors show in Southwestern mining-schemes is beginning to attract a good deal of capital into the Southwest, and it is probable, during the next twelve months, the investments on the part of Eastern and foreign capitalists will be greatly increased. These observations, however, have only an indirect, yet a certain bearing upon the building interests. The manufacturers of lumber in the Northwest, and of iron and steel throughout the great interior of the country have had their attention directed to the corresponding demands of the States west of the Mississippi for lumber and all kinds of manufactured products. These markets will increase their demands upon the States east of the Mississippi because of the great industrial upheaval that is in progress. Even the jobbers of our large Eastern cities are looking with increasing confidence to the west of the Mississippi States, and regard that field as one of the most valuable for their attention. There is a quiet outflow to States west of the Mississippi from States east, because of the extension of the railway system, the cheaper land, and the gradual spread of the smaller industries. The country's industries are balancing themselves. If there be any surplus of capacity in the East it is moving westward. The development of valuable coal fields throughout the far West is one of the reasons for the spread of the smaller industries. Throughout the East the same industrial conditions continue. The importation of iron and steel material and products will likely assume still larger dimensions. New York brokers are in receipt of inquiries from large mill proprietors for extensive supplies of Bessemer pig, Spiegeleisen ore, blooms, slabs, billets, and all heavy material entering into the manufacture of material for railway construction. There is not a single discouraging feature in any of the industries connected directly or indirectly with the iron trade. The lumber manufacturers in the West and South are pleased with the prices obtained, and the prospects for the heavier distribution of lumber next year. The manufacturers of wood-working machinery have been much encouraged by the orders for machinery during the past month and by the reports of agents who have been scouring the country earnestly for next year's work. The textile manufacturers throughout the New England States are watching the course of the market earnestly, but are careful not to crowd prices much beyond their autumn limits. The agricultural interests are better able to exercise control over their stocks this year than last. Thousands of farmers are holding back their products for better prices. They are under less necessity this year to part with their food supplies than heretofore. Speculators are watching the possibilities of European disturbances, and anticipate a heavier exportation of American products in any event. There is very little probability of a speculative advance in any direction, and nothing but a European broil will precipitate such a result. Over-production is not observable in any direction. The coal-producers are short of stocks all along the Atlantic coast, and only this week the anthracite producers met in conclave and decided not to advance prices. The bituminous operators met in Philadelphia on Wednesday of this week and formed a combination for the bettering of prices, and in order to avoid the cut-throat competition which has depressed prices to limits which have for years past driven the miners to engage in the disastrous strikes that have characterized four or five of the Atlantic coast coal-fields. Another influence which should not be lost sight of and to which reference has been made heretofore is the desire of money-lenders in the East to increase their loans in the West and South. This is a very important matter. Confidence has always been lacking in the integrity of borrowers, public and private, in the far-off States. The recent conduct of the new political and commercial element goes far to dispel this distrust and to strengthen the belief in the minds of manufacturers and money-lenders that there is no risk in making heavy investments, especially in reproductive channels. During the past few weeks companies have been formed in New York City and Philadelphia in order to assist in the distribution of money in the West and South in sound channels both for lending and for investments. The bulk of the money-seeking employment remains in the control of its possessors. It is doubtless the better policy. Speaking generally, the industrial situation continues to improve. The depression in Great Britain has been exhausted. Reactionary influences are at work, increasing exportations are assured, better prices are asserting themselves, consumptive demands are expanding, and the general healthy condition of trade and industry is manifesting itself. This improvement affects American markets, and is strengthening demand and stimulating production in all of the greater industries, and the smaller ones are feeling the reviving influence.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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DECEMBER 11, 1886.

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CONTENTS

THE Convention of the American Institute of Architects, held in New York last week, seems to have been a pleasant, and in some respects an important one. The Secretary, Mr. Mason of Newport, was unfortunately detained at home by a severe accident to his father, but the business of the Convention was not materially interrupted. Members were present from the South and West, as well as the Northern and Middle States, and Mr. M. E. Bell, the Supervising Architect of the Treasury Department, set an example which we hope will hereafter be regularly followed by those who may be appointed to this important office. Naturally enough, the committee which drew up last year, in conference with a committee of the Western Association of Architects, the draft of a bill for the reorganization of the architectural service of the Government, desired to take advantage of Mr. Bell's presence to consult with him on this important subject, more particularly since it had been assured that the Conference bill could not pass Congress; and on motion the committee was formally instructed to confer with Mr. Bell, with a view to substituting for the defective measure another draft, better suited to the circumstances which Congress must take into consideration. We shall hope later to present the various addresses and reports in full, so that we need not here attempt to give abstracts of them, even if the meagre accounts in the daily papers enabled us to do so; but it cannot be doubted that they were even more interesting than usual, as reflecting the remarkable growth in influence and importance of the profession during the past year. Of the various discussions, and of the papers read before the Convention, we have hardly more than the titles, but it appears that Mr. Charles F. Wingate, one of the most interesting and suggestive of writers, presented an essay upon the character of the soil under buildings, in which he affirmed that nine-tenths of all diseases were traceable to bad soil, and suggested that architects should take greater pains to ascertain the quality of the ground on which they built, and the methods of improving it. The officers for the next year, as we find the list given in the papers, are Mr. Thomas U. Walter of Philadelphia, who is reëlected as President, and may, we trust, be spared to us for many more reëlections; Mr. O. P. Hatfield of New York, reëlected as Treasurer; Mr. A. J. Bloor of New York, elected Secretary, to succeed Mr. Mason of Newport; and Messrs. Congdon, Le Brun, Littell and Upjohn, all of New York, as Trustees. On the return of Mr. Bloor to the position which he filled so ably and with so great self-sacrifice, years ago, we congratulate the profession most sincerely. Few persons have any idea of the amount of care and labor imposed upon the Secretary of the American Institute of Architects, or of the thoughtful discretion which the holder of that office, as the tangible representative of the profession in the United States, must exercise in answering the innumerable questions asked of him; and if Mr. Bloor, after experiencing so long the cares incident to a most efficient administration of the office, is willing to assume them again, it seems to us that he deserves the lasting gratitude of the profession. We have always thought that the Secretary of the Institute should be well paid for the time and trouble which he must devote to its affairs, and hope that it will not be long before the Convention will come to the same conclusion; but, meanwhile, we are sure that the older members of the Institute, at least, will recognize the debt which it already owes Mr. Bloor, and which may later, we trust, be acknowledged in some more conspicuous manner.

WE regret to notice that during the discussion of the matter of an "official organ" by the Western Association of Architects one speaker referred to the fact that the *American Architect* was early in its career selected by the American Institute of Architects as its "adopted organ for purposes of publication" in such a way as to create the impression that we had made capital of the vote in our dealings with advertisers. The speaker was also somewhat in error as to the foundation of this journal, and we refer him and others interested to the account we gave in our issue for August 13, 1881. So far as we can recall, the fact that the Institute had made the selection referred to — which considering the limited possibilities was not any more flattering than it could help being — was never paraded in this journal itself, though it was probably mentioned in circulars issued during the first year of publication. We have always considered that our acceptance of the office to which we were appointed imposed on us only the duty of publishing without expense to the Institute such papers, reports and documents as it might desire to place before the profession, and which we considered not too voluminous to find a place in a weekly journal. We have not considered that the *American Architect* was the mouth-piece of the Institute, to express its views, uphold its recommendations and advance its theories. Moreover we have never made any special attempt to procure independent reports of its proceedings in convention, feeling that the Institute's officials would furnish us whatever reports it was proper should appear in the Institute's "official organ for purposes of publication."

A STORY is circulating through the newspapers to the effect that a copper-mine has been discovered near the line of the Canadian Pacific Railroad, which furnishes ores so rich, and so easy of reduction, that except for the duty which the United States imposes on metals, ingots of copper from this mine could be sold in New York at a profit for four cents a pound. It is not very likely that more than half of this story is true, but if even half can be depended upon, no news more important to the art of building has been published for a long time. We soon forget the fluctuations in the prices of materials which we use constantly, but the stock-list will serve to remind us that it is only six years since copper sold in New York for twenty-four and seven-eighths cents per pound, and that eight years previously contracts were made at forty-five cents, which is by no means the highest price on the list. At eleven cents, which has been the average rate for a year or two past, this invaluable material costs less than half as much as it did in the dull times of 1880, and the effect of the low price is already apparent in the great extension of its use. Where copper roofing was once considered a luxury, which only the richest could afford, it is now in daily use by men of moderate means, and copper steam-boilers are, if we are not mistaken, already made for those who can afford to make a great future economy by a present sacrifice. The next step should be copper stove-pipes, and even these are now occasionally seen, while sheet-metal stoves themselves are not unlikely to follow, before long, the example which has been set them by the gas-stoves. If the competition of the great Canadian mine should still further reduce the price, copper will undoubtedly take to a great extent the place which tin, zinc and sheet-iron have occupied; and even for castings for stoves and hot-water or sectional steam-boilers, it would be found hardly more expensive, aside from the enormous profits charged upon such goods, and infinitely better.

AN old alarm has, according to the *Builder*, been revived in Germany by Dr. Hülmann, who lectured recently in Halle on the dangers of living in new houses. According to him, the close-fitting of new doors, window-sashes and floors prevents the ingress of fresh air from the outside, while the moisture present in the pores of the new plastering obstructs

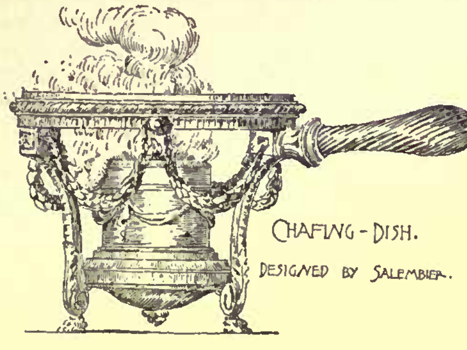
the transpiration of air through it, and aggravates, by the dampness which it communicates to the rooms, the other bad effects of imperfect ventilation. For these reasons, which he enforces by terrifying pictures of the consumption of oxygen, and the formation of carbonic acid in the atmosphere of inhabited rooms, he proposes that no dwelling should be occupied until its walls have been completely dried out, and the time necessary for this drying he considers to be two or three years. A part of this period, he thinks, is taken up by the transformation of the hydrate of lime in the fresh plastering into carbonate, which takes place under the influence of the carbonic acid of the air, and sets free the water of hydration, which fills the pores of the plastering until it has all evaporated; and he proposes that the reaction should be hastened by burning charcoal in the rooms, so as to supply carbonic acid more rapidly. This is by no means a new idea, but as the carbonization of the lime hydrate seldom extends for more than an eighth of an inch below the surface, the danger to health caused by the dampness exhaled from so thin a stratum must be infinitesimal, while the change of air, which the filling of the pores of the plastering with water is supposed to prevent, would be much better secured by means of appropriate ventilating flues. In fact, the health authorities of Berlin itself do not seem to be quite in accord with the Halle sanitarian in regard to the matter, for, instead of requesting the owners of new houses to wait before moving into them until the floors and doors have shrunk so much as to admit a suitable supply of fresh air, as the law authorizes them to do, they now propose to insist upon the ventilation of all dwelling-houses by more efficient methods, and to cease troubling proprietors about the stoppage of the pores in the skim-coat of their rooms.

WE take no little pride in thinking that M. Dieulafoy, whose energetic investigations into ancient Persian architecture have already won for him the highest distinction among working archæologists, and for his devoted wife the very unusual distinction, for a lady, of the decoration of the Legion of Honor, is not only an engineer eminent in his profession, but one of the editors and managers of the *Revue Générale de l'Architecture;* and there can hardly be a doubt that his double set of accomplishments, as an engineer and a student of architecture, have helped him both to make and to understand the discoveries which are now beginning to attract the attention of the civilized world. Until within a few years, the wonderful tales handed down to us from antiquity, about the wealth and luxury of the Medes and Persians, have been received with a certain incredulity, due less to any intrinsic improbability in the stories themselves than to the difficulty of realizing the magnificence of cities and palaces of which now no trace remains; but the labors of M. Victor Place at Khorsabad, and of Mr. Layard at Nineveh, have prepared us, by their revelations of what the Assyrians did, for what M. and Mme. Dieulafoy have discovered about the Persians in Susiana. At Susa, which still retains, almost unchanged, its ancient name of Shushan, these explorers have been able to trace the disposition of all portions of the enormous winter-palace of the kings of Persia, and have discovered innumerable remains of the palace walls and sculptures. The whole building, as shown by these explorations, covered an area of two hundred and fifty acres, or about five-eighths of a mile square. According to the ancient writers, it was all of pure white marble, and the pillars were covered with gold and precious stones, but M. Dieulafoy finds that a considerable portion, at least of the exterior enclosures, was of enamelled brick, arranged in such a way as to form ornamented bands, and even long friezes of figure subjects, of the most effective character for external decoration. Within the first enclosure, which, as usual in Persian and Assyrian buildings, was reached by a vast staircase, stood the palace proper, preceded by the throne-room, which seems to have been about two hundred feet square, and sixty-five feet high, perhaps open in the middle to the sky, but surrounded by a double colonnade. Very little of the material of this room, which was probably quite richly decorated, has yet been found, but a huge capital, sixteen feet high, formed of two gigantic horses' heads, has been discovered in the throne-room, which indicates that this, like most Persian rooms, was covered, at least in part, with a wooden ceiling, supported on heavy beams. Further excavations will doubtless bring to light more traces of that almost inconceivable luxury which reigned in the court of the Persian kings, but for the present the outer walls alone have been sufficiently uncovered to afford us much knowledge of their construction. The main mass of these, which were double, measuring together three hundred and twenty-five feet in thickness, was of unbaked brick, probably faced with enamelled bricks, which are found in great quantities among the débris. As in other parts of Persia and Assyria, these enamelled bricks are shaped like truncated pyramids, having the base only enamelled. The colors of the enamel are principally a sea-green, a greenish or turquoise blue, a yellow, and a brownish purple. The tints and surface of the enamel are well preserved, and the bricks, which appear to be of a sort of concrete, rather than clay, have evidently been exposed to a great heat. The frieze of figures, which represents a procession of soldiers, has a ground of blue and green bricks, and the figures, which are also in bright colors, are raised about an inch and a half from the ground. This must have given a singular brilliancy to the effect, and the description of the whole treatment has many suggestions for modern architects.

ARCHITECTS often have occasion to manage tolerably extensive operations of filling and grading, and many of them have probably wished that there might be some way of estimating a little more accurately than is possible by the common rules, the volume that a given quantity of earth will occupy after a year's settling into its place. The late Mr. Trautwine, who was an extremely practical man, estimated that while a given bulk of earth, loosely thrown out, would at first occupy "in the fill" a space about twenty per cent greater than in the excavation, it would ultimately settle down so as to occupy a volume smaller than the original excavation in a proportion varying from an ultimate shrinkage of eight per cent in gravel, and ten per cent in clay, simply dumped into place, to twenty-five per cent in puddled clay; and these observations, although there is something surprising in the idea that six cubic yards of clay, measured in the cart, will only just fill a hole having a capacity of three-and-three-quarters cubic yards, seem to be approximately correct. In France, even among the accomplished engineers employed on public works, it has been customary, according to the *Annales des Ponts et Chaussées*, to neglect altogether the shrinkage of clay in the fill, on the theory that as earth-work rarely consisted exclusively of one sort of material, the shrinkage of the clay contained in a bank would be compensated by the swelling of the other materials, and where rock, which occupies in an embankment about seventy per cent more space than in the original ledge, forms a part of the material used, this rough averaging of the swelling and shrinkage might do well enough. In clay regions, however, it seems to fail lamentably, and in a recent case, where extensive earth-work was carried out in the clayey soil about Calais, the discrepancy in bulk between the dimensions of the excavation and those of the mass of earth taken from it was so striking that for some time the engineer in charge was supposed to have made a mistake in his profiles or calculations. In order to make sure whether this was so, new measurements were made, both of the excavation and the "fill," and it was proved beyond a doubt that a portion of the material, consisting only of clay, had shrunk to a space twenty-three and one-half per cent smaller than that which it had occupied before excavation; while the remaining portion, which had contained a vein of gravel, had shrunk twenty-two per cent. Whether this clay had been puddled or rammed on being put in place does not seem quite clear, but it seems probable that this was the case.

THOSE of our readers who have telephones in their houses or offices may like to try the following method described in *Le Génie Civil*, of utilizing them for foretelling storms. The first step is to plant in any moist or damp ground two bars of iron, split at the lower end, in order to increase the surface in contact with the earth. The bars should be set fifteen or twenty feet apart, and every week or two the ground at their base should be watered with a solution of chloride of ammonium. Each of the bars is then to be connected with the conducting wire of a telephone in the neighborhood. If this is done, it will be possible, by listening at the telephone, to perceive the approach of storms twelve or fifteen hours before their arrival, and even to notice changes of temperature. A coming tempest produces in the telephone a sound like that of fine hail falling upon a tin roof, while lightning is shown by a short dull sound, and a change of temperature is accompanied by a warbling like that of a flock of birds at a distance.

ARCHITECT, BUILDER AND OWNER BEFORE THE LAW.[1] — II.



A STILL more striking instance of the disposition of courts to prevent people from using the technicalities of the law to evade their obligations is to be found in an Illinois[2] case, where an agreement was made by the abuttors on certain streets for having the roadway covered with gravel. A written contract was drawn up, under which all the abuttors, who were described in it by name, were mentioned as parties, and two of them were appointed as a committee to sign it on behalf of all. One of the abuttors, who may be called A. X., was authorized by a neighbor, whom we will call B. X., and who was one of the committee appointed to sign the contract, to sign the document for him, and did so under the form "B. X. by A. X.," but did not sign it on his own account. A. X. subsequently refused to pay his part of the cost of the gravel, saying that he did not sign the contract, and was not bound by it, but the Supreme Court held that his signature as agent for another person indicated that he had read the contract, and if he had done so he must have seen that he was himself mentioned in it, and that it was intended to bind him as well as the other abuttors, and having under these circumstances signed it as agent for another person, without at the time protesting against his own name being included as a party to the agreement, he must be presumed to have assented to it, and his signature for B. X. ought to be regarded as sufficient evidence that he, as well as the person for whom he signed, intended to be bound by it. In cases where there is a doubt whether the contract is really to be performed within a year, and consequently, whether it must be written and signed, or not, the courts, where there is no indication that any false or improper claim is made, generally hold that although the employment to which the contract relates may not have been actually carried through within a year, still if it could have been so carried through, the agreement relating to it does not fall within the Statute of Frauds, and may be recognized and enforced at law, although not in writing. This view of the subject has a particular interest for architects, who often make verbal contracts for planning and supervising building operations which extend over a much longer time than a year, and, although it would be unwise to encourage them in this hazardous practice, it may not be amiss to say that the conceptions of courts as to the amount of building that might be done within twelve months, if necessary to save a man from undeserved hardship, are based on the most liberal estimates of the rapidity with which it is possible for mechanics to work.

It must be observed, however, that the sanguine fancy of the jury in this regard will not be allowed to be brought into play if the contract or specification, or any other evidence relating to the engagement between the architect and his employer, shows that it was not intended or expected, at the time when the engagement was made, that his task would be completed within a year. If, for instance, as not unfrequently happens, an architect is employed to render the usual professional services in connection with a building to be erected or altered "when the leases expire," or when anything else happens which as both parties know, cannot occur within a year, he should be careful to have his engagement in writing, signed by his client, or he will find his contract, if it should be put to the test, void. If he has done any work for his client, such, for instance, as the preparation of the plans, before receiving notice that the other party abandoned the agreement, it seems to be the rule that he can recover a proper price, to be determined by the jury, for such services as he has already rendered, but the absence of a written contract in such cases debars him from claiming, as he might otherwise do, his full fee, as well as damages, in case his client should think fit to discard him before the work was begun, or while it was in progress, and appoint some one else in his stead.

In the case of works carried out under the ordinary circumstances, it might be thought that a clause in the contract with the builder, drawn up by the architect, and specifying a date for the completion of the building more than twelve months from the time of the engagement of the architect who was commissioned to design and supervise the work, would bring the contract between the architect and the owner within the Statute of Frauds, and make it void if not in writing: but the architect is, under such circumstances, protected to some extent by the consideration that it might not have been known, when he agreed with his client, that so long a time would have to be allowed for the building operations; and even if this resource should fail him, it has been held that the assignment, in a verbal contract for building, of a date of completion more than a year from the time when the contract was made, did not bring the contract within the Statute of Frauds, for the reason that the agreement in fixing the date "at or before" which the building should be finished, did not forbid the builder to complete it many months before the contract time, if he wished to do so, and thus fulfil his agreement within the year, while the statute related only to contracts which obviously could not be completed within that time.

Unless the agreement between the architect and his employer relates to work which is not to be performed within twelve months from the time of making the agreement, or unless the former's services are rendered or promised in consideration of marriage, which is naturally not a common experience among architects, or unless the architect is to receive a piece of land or other real estate as compensation for his services, it is not necessary that the agreement should be in writing. On the contrary, it may be verbal, or implied, or partly written, and partly verbal, or implied, and will be just as binding as if written, and signed by the parties, and can, if there is no difference of opinion between the parties as to what the agreement was, be as easily enforced at law as a document in writing. Unfortunately, men are in such matters too often forgetful and careless. They do not pay attention to what is said to them, and forget what they said in reply, and it is consequently very common to find the parties to a verbal contract a few weeks afterward differing widely, although perhaps conscientiously, as to what it was that they mutually agreed to do. In case of a controversy on the subject the testimony of one party about the agreement, if no fraudulent intent is apparent, is just as good as that of the other, and whether a jury decides that one party is wholly right, and the other wholly wrong, or strikes an average between the two claims, as it is more disposed to do in doubtful cases, there is sure to be disappointment on one side or the other. Architects, who are accustomed to hearing the conflicting assertions of their clients and the contractors as to what agreements or promises have been made during the progress of works under their charge, hardly need examples of the distortions which the remembrance of facts will suffer under the influence of self-interest; but it may be well to remind them of the numerous instances in which members of their profession, after having done work in pursuance of a verbal engagement, have been met, on presenting a bill for their services, with the answer that the party who employed them perfectly well remembered that they had agreed to render those services for nothing. In many cases the employer honestly believes this, basing his belief perhaps on some remark or action of the architect which neither can accurately recall, and if the architect fails to convince the other of his error, or refuses to accept a compromise in the matter of his bill, he must be prepared to hear his employer swear in court solemnly, and in good faith to facts which never existed outside his own imagination. To do the courts justice, they are generally unwilling to believe, without better evidence than unsupported assertion, that any professional man would be foolish enough to spend his time and skill for nothing; but, to use the words of an American judge, if two equally credible persons give directly opposite testimony, the testimony of one "neutralizes" that of the other, and the architect who is so unhappy as to become involved in a dispute in which he has nothing but his recollection of a verbal agreement to rely upon is likely to find the compensation which he recovers measured by something more than the residue which remains after deducting his opponent's claims from his own. There will be much more to say upon this subject when we come to the relations of the builder with the other party to his contracts, but architects will do well to take notice that as they are more likely than builders to make their contracts orally, so the results of their labors being less tangible than those of the builder's work, they are often worse prepared to convince a jury of the justice of their claims.

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[1] Continued from page 228, No. 568.
[2] Keyfoot vs. Cromwell Mound Co., 115 Ill., 502.

The best remedy for the inconveniences and dangers of verbal contracts lies in the provision of written memoranda, which will not only serve to refresh the memories of the parties themselves, but, if a controversy in regard to the contract should be brought into court, will be of the greatest importance as evidence. In fact, so great is the value which the law attaches to writing, that if either party can produce a letter or written memorandum of any kind which goes to show what the terms of an agreement were, a court will generally decline even to listen to a witness who endeavors to refute, by quoting mere conversations, the evidence afforded by the written document. It is not necessary that the writing should be in the shape of a formal contract. Letters, with replies to them agreeing to the terms proposed in them, are excellent evidence of the intention of the parties, and an agreement made in this way cannot easily be broken by either party. So also, if an architect, for example, should write to an intending client, mentioning his terms for his services, or, as is often done, enclosing a tariff of prices, and the other should not at the time make any objection, but should request the architect to proceed with the work, and should suffer him to carry it to completion, the letter would be regarded as showing the terms agreed to between the parties, and only strong and direct evidence of its having been verbally set aside would be admitted to contradict it. Even if the person to whom the architect offered his services on certain terms should not actually request him to render those services, but should offer no objection to his doing so, and confer with him or otherwise recognize his actions as the work went on, and should at the end profit by his labors, he would be assumed, unless he could show evidence to the contrary, to have agreed to the terms which the architect proposed at the beginning.

In default of formal agreements, or of terms submitted in writing by one party, and either expressly or tacitly acquiesced in by the other, a comparatively vague memorandum of the agreement, or of the understanding existing at the time between the parties will be much better than nothing, and will give the one who can produce it a great advantage over persons who have nothing to depend upon but their own assertions in regard to the circumstances, which are very likely to be flatly contradicted by the assertions of the opposing party. In such cases, even a memorandum of the terms agreed to, or the request made by the party to be charged, or of any other item of the understanding between the parties, made by the person who afterwards desired to profit by it, would be far better than nothing, and if he could satisfy the jury by the examination of the note-book in which it was written that it was made at the time, and in good faith, he might find it of considerable service.

Still better than this, in the case of a verbal contract of any kind, is a note of the circumstances of the agreement, made by a third party, especially if the third party was a person familiar with the subject-matter of the contract, and was present when the verbal agreement was made, and took note of it at the time in writing. In the absence of a written document signed by the parties, or of a letter from one of them expressing the terms which he offered, with written or tacit acceptance of them by the other, such an impartial memorandum would have great weight, and could hardly be contradicted by the mere recollection of one of the parties. Although architects are not, perhaps, likely to need such testimony very often in their own behalf, they may be of great service to their clients by remembering the value of it, and acting themselves as the impartial takers of notes in regard to bargains made between their clients and others in their presence. As all architects know, the approaching completion of a building, particularly of a dwelling-house, usually serves as the signal for a multitude of minor agreements, relating to grading, planting, furnishing and other matters. Although the proprietor commonly makes his own bargains for these matters, the architect is frequently consulted about them, and is in consequence often present when the agreements are made, and, as the agreements are almost always verbal, and consequently liable to be misunderstood or partially forgotten on one side or the other, the architect can help both parties, but his client more particularly, by writing down the items of the bargain, with the date and other important circumstances, in such a way that his note can be subsequently referred to. It is an excellent precaution, also, particularly where one of the parties is a gardener or contractor, not much used to exact expression, to read the memorandum to the parties, and ask them if that is their understanding of the agreement, adding to the memorandum a note of this question and the reply.

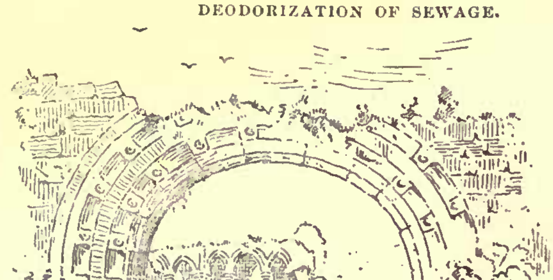
As in most of their worldly affairs, so in the making of contracts, men are generally in too much of a hurry for their own good, and forget, or leave out, or stumble vaguely over, or postpone for future consideration, the very points which it is most necessary for them to have most clearly understood. Some persons are afflicted with an excessive timidity or politeness, which leads to an habitual fogginess of expression in their business dealings, as if they feared to wound the feelings of others by a brusque directness of demand or reply, and many more, under the influence of a craftiness which is not incompatible with timidity, habitually conceal their real intentions, and make their bargains in vague terms, to which they hope to be able later, after they have been accepted, to ascribe a meaning very different from that which the party who accepted them had in mind, and much more advantageous to themselves. It is true that the courts generally make short work of these astute practices, and it is often laid down on the highest authority that the true interpretation of an agreement, and the one to which the law must give effect, is that interpretation which the man who proposes the agreement thinks that the person to whom he proposes it puts upon it at the time; or, to say the same thing in another way, any uncertain or incomplete expression in a contract must be understood in the way in which he who proposed the contract thought that the other party then understood it; but, although architects will do well to remember this, which is the rule by which the law interprets contracts, when they have to decide between their clients and their contractors in regard to imperfectly defined stipulations, they should beware of admitting any such incomplete or ambiguous expressions to their own negotiations with either client or contractor. The principle to be always borne in mind is to describe all the stipulations on which it is desired to insist as plainly as possible, leaving nothing to be inferred or supplied. Architects are apt to fear offending their clients by appearing too anxious, at the beginning of their relations, about their fees, but a man of moderate tact need have no apprehensions on this point, and for one client who really intended to pay a proper fee, and who was driven away by being asked to signify his intention definitely at the outset, there would be a thousand who would be glad to start with a definite understanding between themselves and their architects as to the services to be rendered, and the compensation to be paid for them.

Taking things, however, not as they should be, but as they are apt to be, we must see what the law will do for a man who neglects to protect his own interests by saying distinctly what he proposes to do, and what pay he expects for doing it, and getting the assent of the other party to his proposition, before he enters upon any undertaking.

[To be continued.]

THE TREATMENT OF SEWAGE.[1] — V.

DEODORIZATION OF SEWAGE.



TO get rid of the offensive smell of sewage has been a fruitful subject for investigation. Since the time of Davy, who investigated the deodorizing power of different chemicals on night-soil, numerous experimenters have worked at it.

The following are the results of Letheby's experiments showing the quantities of different disinfectants required to deodorize ordinary London sewage. The substances were added until subsequent decomposition was entirely prevented, or more sewage smell removed.

[1] A paper by Dr. C. Meymott Tidy, read before the Society of Arts, April 14, 1886, and published in the *Journal* of the Society. Continued from No. 570, page 257.

Dr. Letheby notes that no doubt a less amount would suffice, provided the precipitate produced by the several chemicals was removed as fast as formed: —

	Grains required per gallon.	Results as to deodorization.	Composition.	
Quicklime...........	12	Incomplete.		
Chloride of lime....	8	Complete.		
McDougall's powder	40	Incomplete.		
Peat charcoal.......	150	do.		
Condy's liquid......	150	Complete.	4,357 grs. per gal. of Permanganate of potash.........	sp. gr. 1055
Dale's "	315	Incomplete.	64,827 grs. per gal. of Perchloride of iron...............	" 1470
Ledoyen's "	1000	do.	8.120 grs. per gal. of Nitrate of lead..................	" 1160
Ellerman's "	470	do.	43,434 grs. per gal. of Muriate and pyroligneate of iron..	" 1443
Burnett's "	100	do.	60,031 grs. per gal. of Chloride of zinc..........	" 1594

The cost may be thus stated:

	Price at.				Cost for deodorizing 100,000 gallons.		
	£.	s.	d.		£.	s	d.
Quicklime................................	0	10	0	per ton.	0	0	9
Chloride of lime........	15	0	0	"	0	15	4
McDougall's powder.	12	0	0	"	3	1	3
Peat charcoal..................	3	5	0	"	3	2	3
Condy's liquid..................	0	1	0	per gal.	10	14	4
Dale's "	0	0	6	"	11	3	7
Ledoyen's "	0	0	4	"	23	16	4
Ellerman's "	0	0	9	"	25	3	6
Burnett's "	0	4	0	"	28	12	0

STRAINING, FILTRATION AND SUSIDENCE.

Many attempts have been made not only tu strain and filter sewage, but also to allow the deposition of the larger pieces of the suspended matters in tanks, with or without straining. As a fact, it is impossible to strain sewage efficiently, or to effect deposition without previous treatment. If the straining material be of fine texture, such as of wire, it soon clogs, whilst if it be of coarse texture, it is of no use. If fine gauze, or an iron grate be used, the albuminous matters soon choke it, and prevent further action. In Baldwin Latham's self-cleansing extractor, an ingenious contrivance in use at Dantzic, Croydon, Coventry, etc., and consisting of a vertical strainer rotating about a horizontal axis, the solid matter being raised from a central receptacle by an Archimedean screw, the most that can be said is that the grosser matters are removed. But even here, a considerable play of water upon the gauze is required to ensure its action. It was formerly a common practice to strain the sewage through wooden planks perforated with ¾-inch apertures, before applying it to land (as at Newcastle-under-Lyme, Southam in Warwickshire, Aldershot), a proceeding that reduced the suspended matters some nine or ten per cent.

Of the attempts at filtration, the following cases may be noted: —

(1) Gravel was used at Abergavenny, Alton, Ashby de la Zouch, Atherton, Cheltenham, Coventry, Ludlow, Oswestry, Saffron Walden, Southam, Tewkesbury, Walton-on-the-Hill,

(2) Burnt gravel was tried at East Barnet.

(3) Cocoa matting and gravel strainers were tried at Wellingborough.

(4) A filter of gorse, with broken stones, was tried at Ulverstone.

(5) Charcoal, or coke, or ashes, were used at Bacup, Bishop Auckland, Canterbury, Chelmsford, Chesterfield, Croydon, Uxbridge and Bilston.

(6) Straw strainers, with ash-filter beds, were tried at Bilston and at Canterbury. Straw filters alone were used at Buxton.

(7) Charcoal and gypsum were tried at Bury St. Edmunds.

(8) Charcoal and gravel filters were tried at Ealing, Fareham, Harborne, Newcastle-under-Lyme.

(9) A filter bed consisting of straw, dry earth, ashes, sand, heath, and burnt clay was tried at Hurstpierpoint.

(10) Peat was tried at Bradford. (1873).

(11) Sand was tried at Ely, Rugby and Birmingham.

(12) An iron slag filter was used at Merthyr Tydvil.

A combined system of subsidence and filtration has been attempted on many occasions. This method was formerly adopted at Birmingham, where the sewage was conveyed through a series of tanks, the passage occupying about two hours. Two sets of tanks were employed, each set being worked continuously for about a fortnight, when the sludge was removed and consolidated by evaporation and soakage in properly-prepared pits. The effluent water was found to be offensive, and the works a nuisance. Coventry formerly adopted a similar process, a coarse gravel filter running the whole length of one tank being employed, through which it passed into a second, and again into a third tank of small gravel. The purification proved very inefficient.

At St. Thomas, adjoining Exeter, a similar method of defecation by subsiding tanks, iron strainers, and gravel filters (forming the tank boundaries) was adopted, although in this case a little lime and about 0.75 gallon of carbolic acid to 200,000 gallons of sewage, were added. The carbolic acid proved valuable.

At Uxbridge again, a combined system of subsidence, straining through a grating, and filtration through charcoal is adopted, before the sewage is discharged into the Colne. It is, however, quite certain that mere subsidence and filtration, as methods of sewage treatment are failures.

We may here mention the suggestion of Strang, of Glasgow, of treating the sewage discharged from a water-closet, by upward filtration through a box containing the refuse ashes of the house. By this means the solid matter is retained in the lower part of the vessel, and the liquid matter passes through the ashes. Dr. Anderson, of Glasgow, reports well of the apparatus. Mr. Austin, late of the Local Government Board Office, was of opinion that sewage might be dealt with by placing a series of portable filters in the sewers. (Society of Arts Conference, 1877, p. 14). By this means much of the kitchen stuff could be kept out of the sewers, which, it is true, is often as objectionable as, if not more objectionable than the sewage itself.

Whatever filtering material you use, be it sand, gravel or charcoal, two difficulties are inevitable: (1) That the filter soon becomes choked, when it fails to act, or acts inefficiently; (2) that the matters deposited on the surface of the filter, cause an insufferable nuisance It may be said, as regards the first objection, you have only to recharge your filters and to utilize the old material for manure. The answer is, the cost of material and of labor, and the difficulty of securing a sale for your refuse. To meet the second objection it is said, "Cultivate the surface of your filter beds, whereby vegetation can be made to use up the obnoxious matters." In practice, however, this is not successful, whilst it is impossible to secure a crop all the year round.

I know of no place where filtration alone has proved a success hygienically. Of course intermittent downward filtration is practically land filtration. The objections urged to general filtration, apply equally to land filtration.

Some interesting details respecting the filtration of the foul water of the River Plate is given by Mr. George Higgin ("Proc. Inst. Civil Engineers," vol. lvii). They show the extreme difficulty of filtering this impure water, a difficulty which is nothing compared to that of filtering sewage.

DISCHARGE OF SEWAGE INTO THE SEA.

Seeing sewage is worth so little, it is no wonder that local authorities have been desirous, where possible, to get rid of it by permitting its discharge into the sea (see Hawksley's Social Science Address, 1876, p. 28). This has been done at Weston-Super-Mare, St. Leonards, Torquay, Eastbourne, Llandudno, Dover, Carnarvon, Brighton, Margate and Ramsgate. There is much to be said in favor of this method. No doubt it appears wasteful, but nature is certain to utilize in due course in her own way what we fail to utilize in ours. But it must be noted that a nuisance is possible if the sewage be discharged into the sea too near land, from the foul matters in suspension being brought back again by the tide to putrefy on the shore during low water. This was said to have occurred at Dover ("*Proc. Inst. Civil Engineers*," vol. xliii. p. 221), and at Carnarvon. A stink may result, moreover, from the reduction of the sulphates of sea water to sulphides by the organic matter in the sewage, and the evolution of sulphuretted hydrogen by the action of carbonic acid on the sulphides so formed. Possibly to some such cause the smells and unsanitary condition of the Bay of Naples, the Port of Marseilles, the Bay of Cadiz, the West Coast of Africa, and other places owe their origin. This difficulty is worth considering, moreover, more particularly in those cases where a town extends down to the water's edge. No doubt further sewage matters, flocculent materials, corks, etc., have a special tendency to float on sea water, continuous decomposition resulting. Difficulties have arisen at Margate, Ramsgate and Brighton, from these several causes.

Evils resulting from the discharge of sewage into tidal rivers, containing sea water have occurred at Glasgow and towns adjacent, where the sewage was taken into the Clyde, and were investigated by Sir John Hawkshaw in 1874, who recommended its discharge into the Firth of Clyde at Farland Head. The discharge of sewage into the Thames was also a subject of inquiry by a Royal Commission, and was discussed by Professor Stanley Jevons in a letter to the *Times* of December 2, 1878. I need only point out that the discharge of sewage into a tidal river involves cost of dredg'ng (See Rivers Pollution Commission, 2d report, 1868, p. xiii).

Regarding sewage (which I do) as a thing to be got rid of, and for which we must be prepared to pay to be rid of it, there are manifest advantages in taking it out to sea or estuary. It should, however, in such cases, be discharged in deep water, at a considerable distance from land below the line of low water, and where there is a well-ascertained current to carry it permanently seaward. Careful tidal observations are needed before deciding on the point of discharge. A spot where there is an oscillating action resulting in a return of sewage matter either in the neighborhood of the discharge, or at distant places to which the tide carries it, must be avoided — in other words, we must not allow a turn of the tide to carry one person's refuse to somebody else. It is difficult to imagine a nuisance resulting under carefully considered conditions, more particularly if the discharge-pipe be some distance from the town, and the town itself well above the sea level. Still, even in all cases, it is worth considering whether or not some process of clarification may not be advisable.

It is worthy of note, that chloride of magnesium is itself a precipitating agent for sewage. Again, sea water, owing to the common

salt present in it, has a tendency to reduce the ease with which organic matter is oxidized. Thus the oxidation of the organic impurity of the sewage is less rapid when it is discharged into salt water, than it is when discharged into fresh.

In the "mud inquiry," the Conservators of the Thames contended that certain sewage banks in the river were caused by the sewage outfalls at Barking and Crossness. In time, these sewage deposits putrefy, rise to the surface, give off offensive gases, ultimately sinking to undergo fresh putrefactive changes. It is certain that in a tidal salt river, foul banks of sewage mud may form, which in ordinary rivers would not be produced. Of course, I admit that a strong tidal current might carry these masses away, but in the absence of such current, they subside and mingle with the sand and mud of the beach.

The bill of 1875, promoted by the West Kent Main Sewerage Board, was for the purpose of conveying the sewage of Bromley, Beckenham, Hayes, Orpington, Chislehurst, The Crays, Bexley, Crayford, East Wickham, Erith and Dartford, to Long Reach on the River Thames, eight miles below the outfall of the metropolitan sewage.

PRECIPITATION PROCESSES.

By "chemical precipitation," or "the chemical treatment of sewage," is implied the addition of certain chemicals to the sewage, whereby the deposition of the solid suspended matters and some of the dissolved matter from the formation of insoluble compounds, together with the deodorization of the offensive constituents precipitated or dissolved, is effected.

The general features of a chemical process for sewage may be thus described: —

To the sewage (from which the grosser suspended matters may or may not be removed), chemicals are added, either suspended in water or, if soluble, dissolved in water. After this treatment the sewage is allowed to flow into subsidence tanks, where either it is allowed perfect rest for a few hours or is passed through a series of tanks continuously, in order, in either case, to allow the deposition of the sludge — that is, of the matter in suspension. The clear effluent is then allowed to flow either directly into a water-course, or over land previously to its discharge. The black fluid or sludge in the tank (of which 90 per cent is water) is then all that remains to be dealt with.

The precipitants to be employed have been subject matters of numerous patents. Of these we shall note the most important.

I. — PROCESS INVOLVING THE USE OF LIME AS THE CHIEF PRECIPITATING AGENT.

Lime. — The use of lime for disinfecting excreta was the subject of a patent in 1802 (Estienne). In 1844 lime was used to purify the Manchester sewage before discharge into the River Medlock. This was done at the suggestion of Dr. Clark of Aberdeen, who, at that time, was at work at his process for softening water by the use of lime, and, as the result of which he was led to suggest its use for sewage precipitation. It was abandoned for a time at Manchester on the ground of cost (a ton of lime being required daily), but was readopted in 1854, at the suggestion of Crace Calvert, who advised, after the addition of two or three grains of lime per gallon, complete rest of the liquid so treated in subsidence tanks, his report stating that the precipitate subsides rapidly, the supernatent water being clear, colorless and inoffensive.

In 1846 Mr. William Higgs took out his patent for the treatment of sewage in subsiding tanks or reservoirs by means of chemical agents. For the purpose of precipitating the solid animal and vegetable matters contained therein, hydrate of lime (commonly termed slack lime) was preferred. In 1851, Mr. Thomas Wicksteed patented a process for manufacturing manure from sewage, etc., by admixture with lime, collecting the deposit and submitting it to certain centrifugal drying machinery, thus obtaining, to use his own words, "the manure as fertilizing material in a state commodious for transport."

Action of Lime. — When lime is added to raw sewage, a carbonate of lime is first formed. This acts as a weighing material, whereby, if the opportunity be afforded, the light flocculent suspended matters will be carried down along with the precipitated carbonate. In addition to this, however, a certain proportion of dissolved organic matter is also precipitated, the lime forming with the organic matter a compound of uncertain chemical composition.

Crace Calvert, operating on the Manchester sewage, gives the following as the average results of five days' treatment by lime: —

	Matters in solution.			Matters in suspension.		
	Total solids.	Mineral.	Organic.	Total solids.	Mineral.	Organic.
Raw sewage.	32.00	23.46	8.54	6.65	3.08	3.57
Effluent.....	25.76	22.26	3.50	0	0	0

The action of lime on London sewage was the subject of a prolonged investigation by Dr. Letheby during the time I acted as his assistant.

In Calvert's experiments on Manchester sewage the lime effected the entire removal of the suspended matter (mineral and organic), and more than 50 per cent of the dissolved organic matter. In Letheby's and my own experiments the removal of all the suspended matter was effected, and about one-fourth of the dissolved organic matter.

The action of lime was further investigated and reported on by Hofman and Witt as one of the most promising of the many processes for obtaining a deposit from sewage, which, when dry, might be employed as manure. Operating on London sewage with 20 grains of lime per gallon (800 grains of lime to 40 gallons of sewage), the following results were obtained: —

	Matters in solution.			Matters in suspension.		
	Total solids.	Organic.	Mineral.	Total solids.	Organic.	Mineral.
Raw sewage.	107.6	52.36	55.24	52.49	36.4	16.09
Effluent.....	96.02	40.34	55.68	traces	traces	traces

In other words, 20 grains of lime removed all the suspended matter, and more than one-fourth the dissolved organic matter.

After the addition of the lime a flocculent precipitate is formed. This settles at the rate of about one-fourth part the bulk of the liquid in one hour. The clear supernatent liquor is colorless, clean, and comparatively odorless. Hygienically, the process is successful — commercially, it is not successful, because the precipitate is mainly carbonate of lime and non-nitrogenous organic matter.

These laboratory experiments are confirmed by practical working. Thus Higgs's process was used at Tottenham in 1857, the results being so satisfactory that the Local Board of Health gave a testimonial certifying to its efficiency (sewage treated 175,000 gallons daily, or sewage of 10,000 persons — 12 grains of lime added per gallon [1 ton per week] — dry precipitate obtained was four to five times the weight of the lime used). That the success was no mere accident is proved by the high eulogium passed on the process by Normandy and Miller in the action brought by Higgs against the Hitchin Local Board for an infringement of his patent.

Why, then, was not this hygienic success continued? The reason

TOTTENHAM.

	Matters in solution.				Matters in suspension.		
	Total solids.	Organic.	Mineral.	Ammonia.	Total solids.	Organic.	Mineral.
Raw s'ge.	54.50	9.49	45.01	2.60	39 99	14.53	25.46
Effluent.	48.99	8.01	45 98	2.84	1.69	0.37	1.32

is obvious — the manure was found to be of so little value that the commercial result proved a failure, Mr. Higgs transferred his expensive works for a merely nominal sum to the local authority, who (in spite of their testimonial showing the capabilities of the process) so neglected them that shortly after the transference an injunction was obtained by the trustees of the River Lea, to prevent foul, undefecated sewage being discharged from the works. Carelessness and parsimony are certain to ruin the best of processes.

Wicksteed's process was adopted at Leicester in 1855, the works

LEICESTER.

Constituents per gallon.	Matters in solution.				Matters in suspension.		
	Total solids.	Organic.	Mineral.	Ammonia.	Total solids.	Organic.	Mineral.
Raw s'ge.	70.00	13.49	56.51	2.52	19.15	5.50	13.65
Effluent.	66.99	10.65	56.34	2.61	1.40	0.49	0.91

which cost £30,000 to £40,000 being managed, in the first instance with marked success. [Sewage treated (1858), 2,000,000 daily, or the sewage of 65,000 persons, 3 to 16 grains of lime were added per gallon. Sludge (dry) was 3 to 4 times the weight of the lime used].

Very high was the commendation passed on this process by Aitkin and Taylor, after a minute investigation in 1851. But the Corporation shirked the lime and neglected the works. No wonder that the River Soar, into which the effluent is discharged, became foul, a result which is certain to be attributed by partisans to failure of the lime process rather than to its true cause, viz., the miserable carelessness and false economy of those to whom the management was entrusted.

The value of the sludge precipitated by lime has been variously estimated as from 15*s.* 6*d.* to 29*s.* 6*d* per ton. Voelcker, who fixed 15*s.* 5*d.*, gives the following as its composition: —

		Value per ton. £
Moisture..	10.52	—
Organic matter..................................	12.46	1
Phosphate of lime...............................	2.27	7
Mineral matter..................................	54.75	—
	100.00	
Nitrogen..	0.60	—
Ammonia...	0.72	56

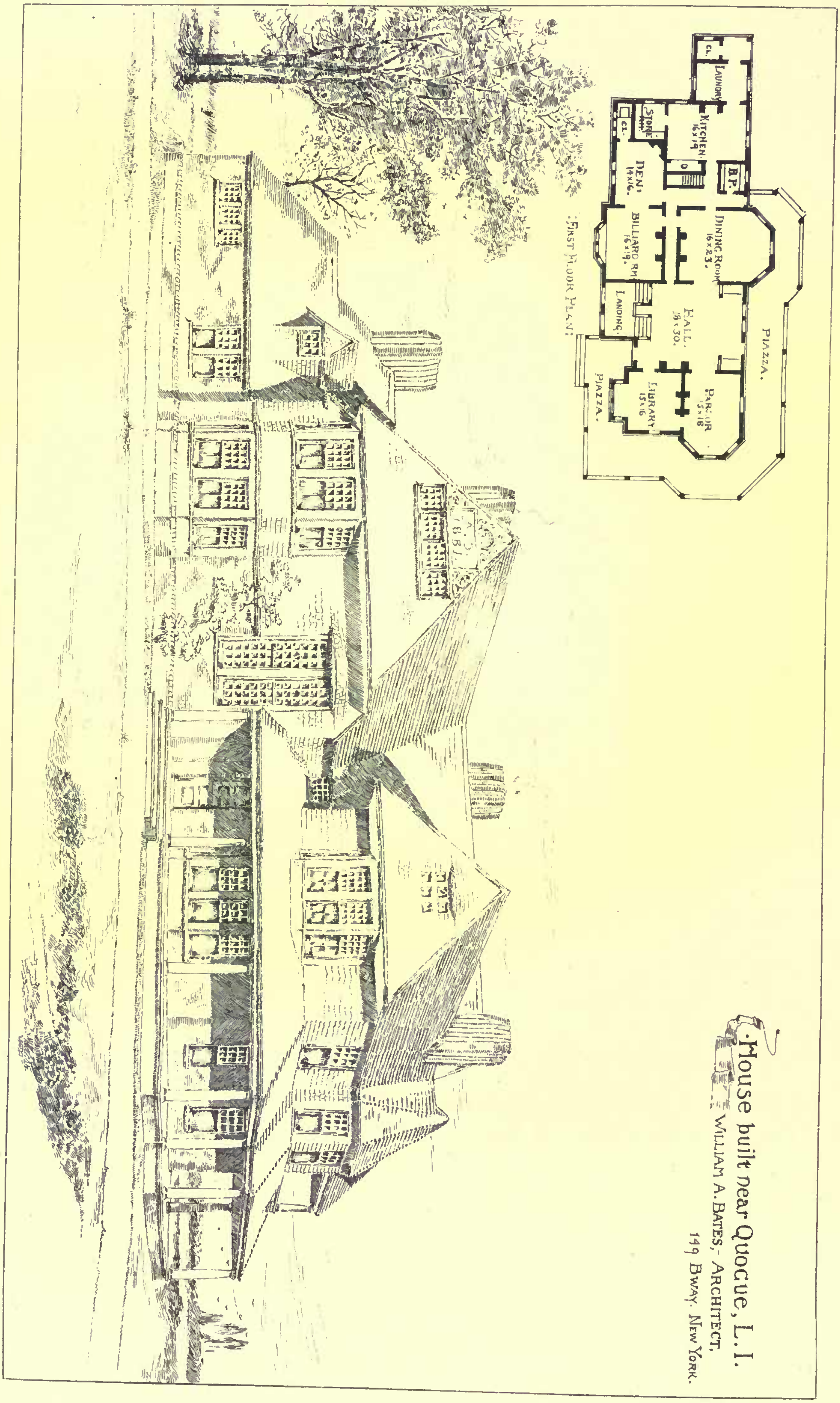
No doubt, as an agricultural article, this manure is worth very little indeed compared to the extravagant views entertained of its fertilizing power by the earlier patentees. Local authorities have to learn that to treat sewage means outlay, and that cost is no excuse for neglect.

I conclude by laying down certain essentials for the successful treatment of sewage with lime: —

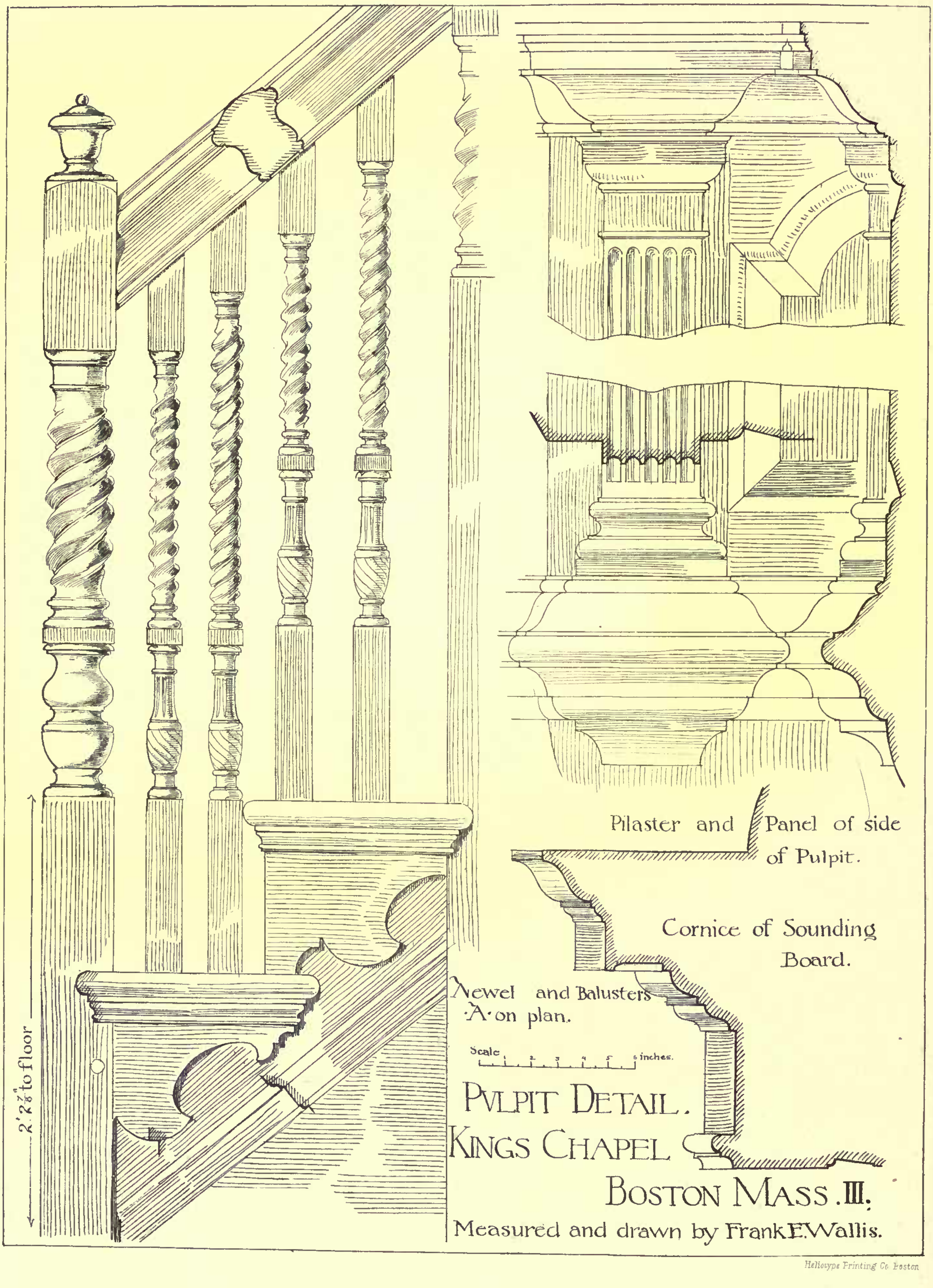
1. The lime used should be in perfectly caustic state, and before admixture with the sewage should be thoroughly slaked and mixed with sufficient water to render it the consistency of a thick cream.

2. That the quantity added should not be less than ten grains per gallon, to a sewage that does not exceed thirty gallons per head of the population.

3. That very complete agitation of the lime with the sewage is advisable in order to secure perfect admixture of the lime and flocculation of the precipitate, thus rendering the after subsidence more

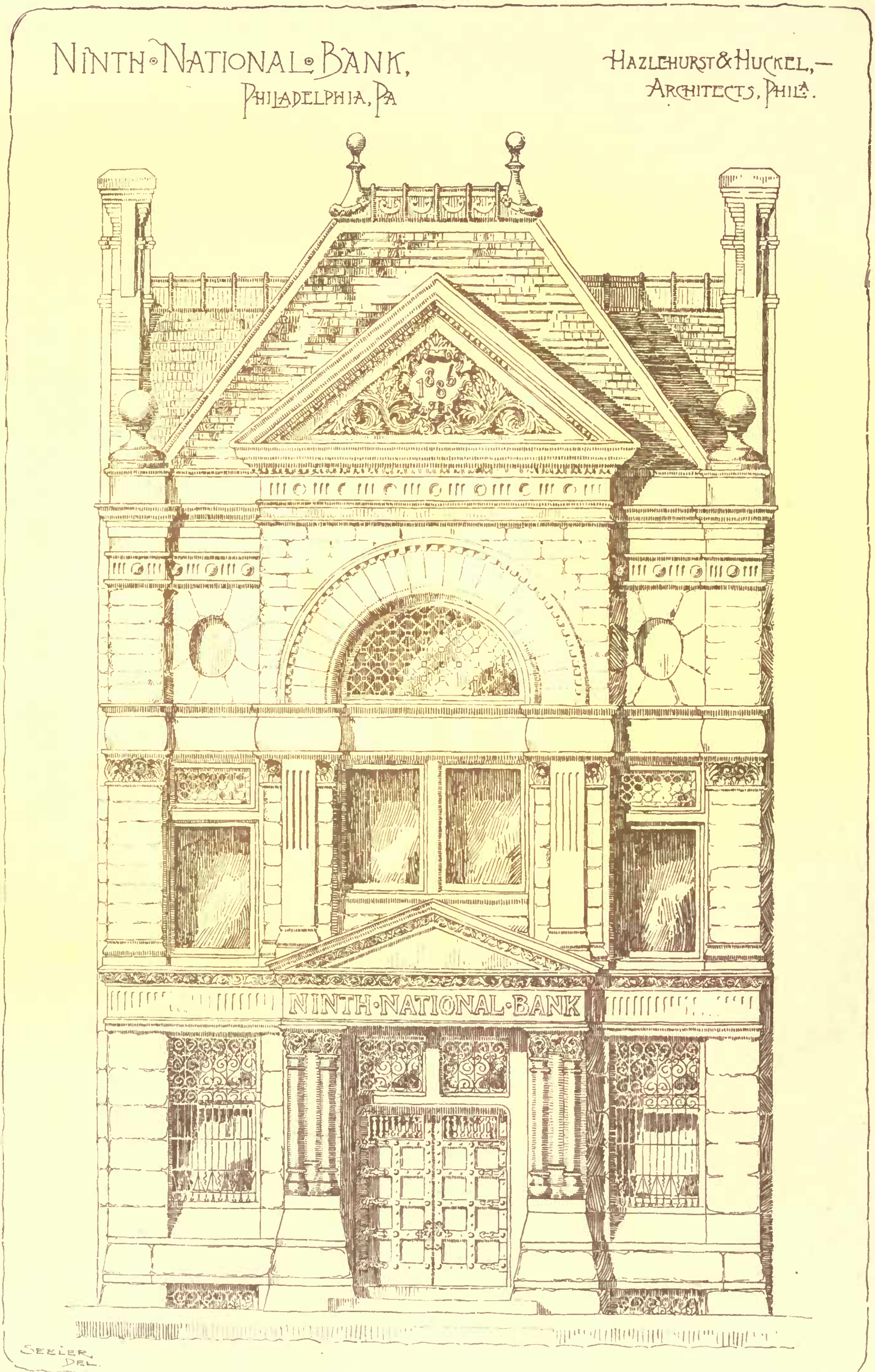


House built near Quogue, L.I.
William A. Bates, Architect,
149 Bway. New York.



Heliotype Printing Co. Boston

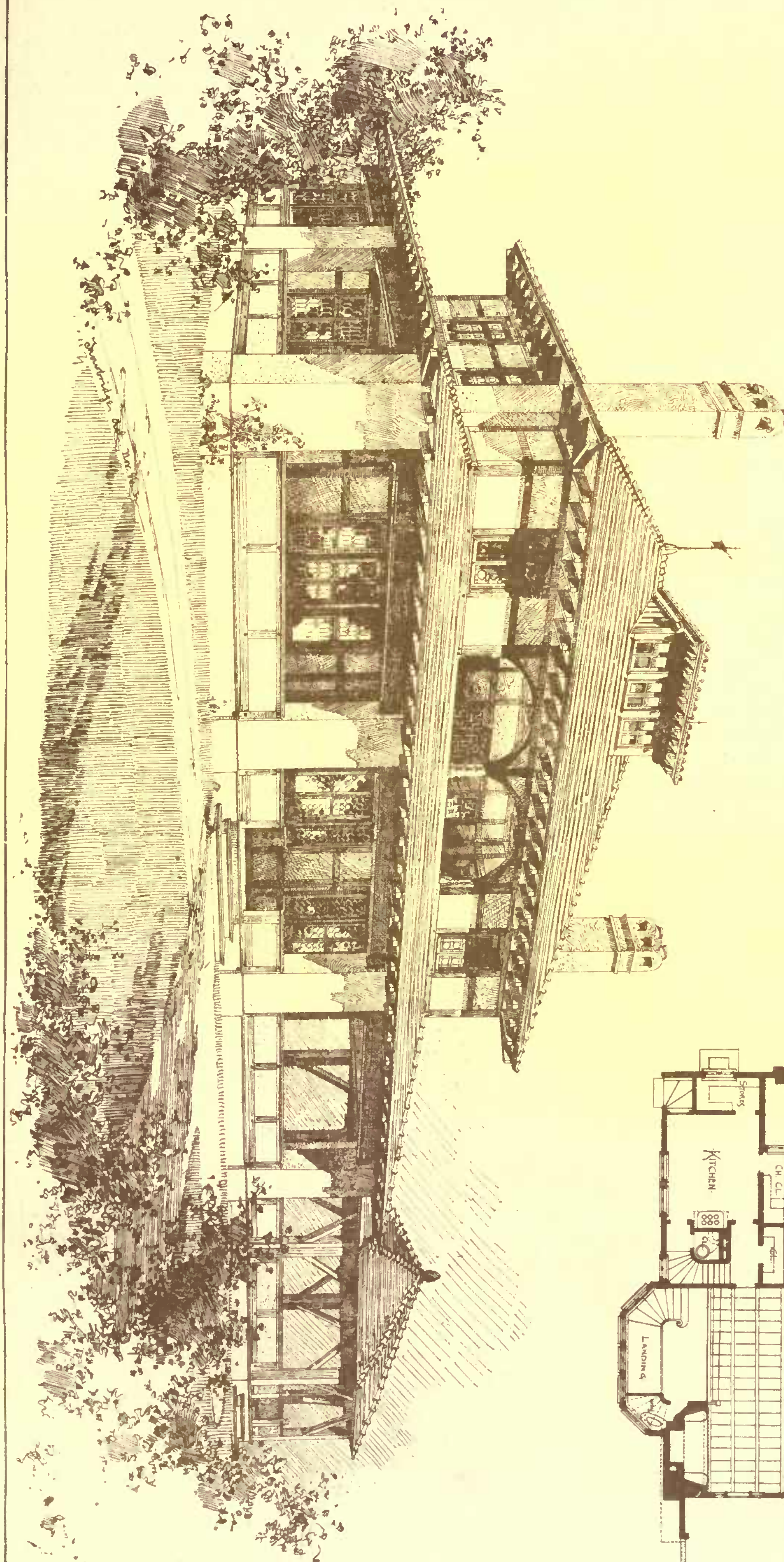
Old Colonial Work.


Ninth · National · Bank,
Philadelphia, Pa
Hazlehurst & Huckel, —
Architects, Phila.
1886
Ninth · National · Bank
Seeler
Del.

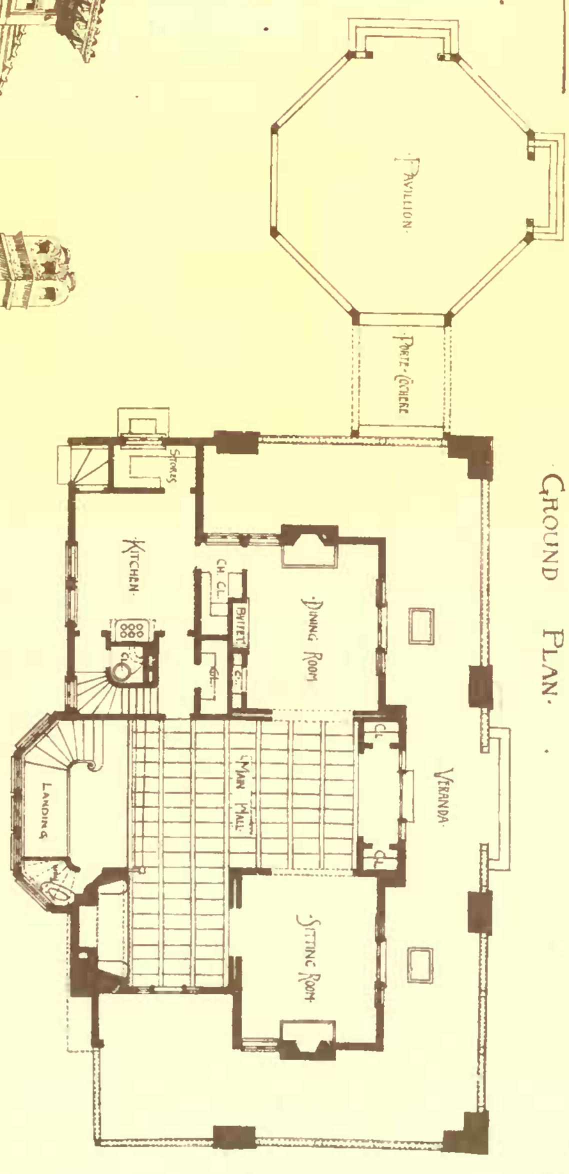
RES. FOR H.Q. CHENEY ESQ., CAVAGNA FARM.

BUDDEMEYER, PLYMPTON & TROWBRIDGE

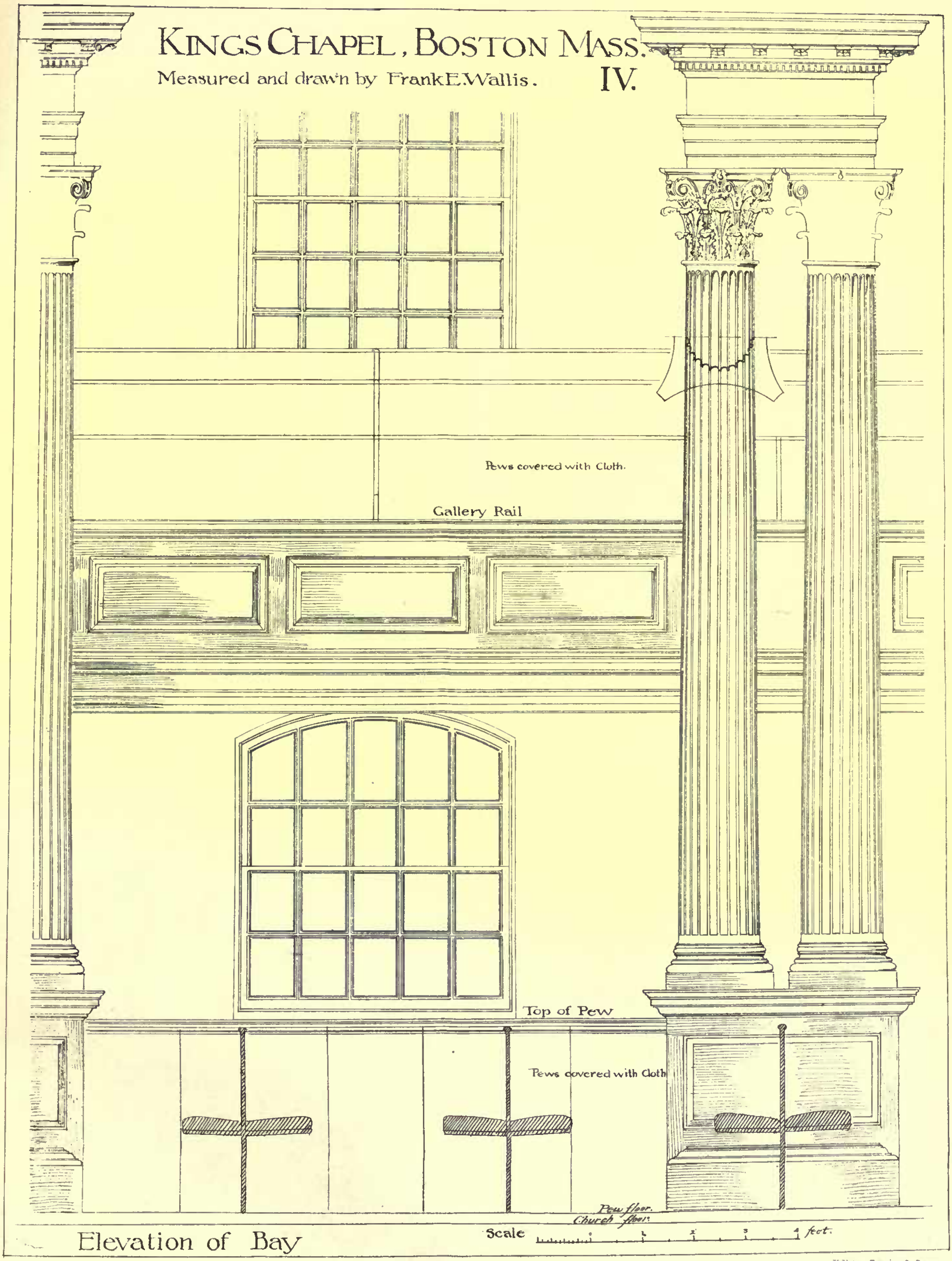
ARCHITECTS · CIN., O.



GROUND PLAN.

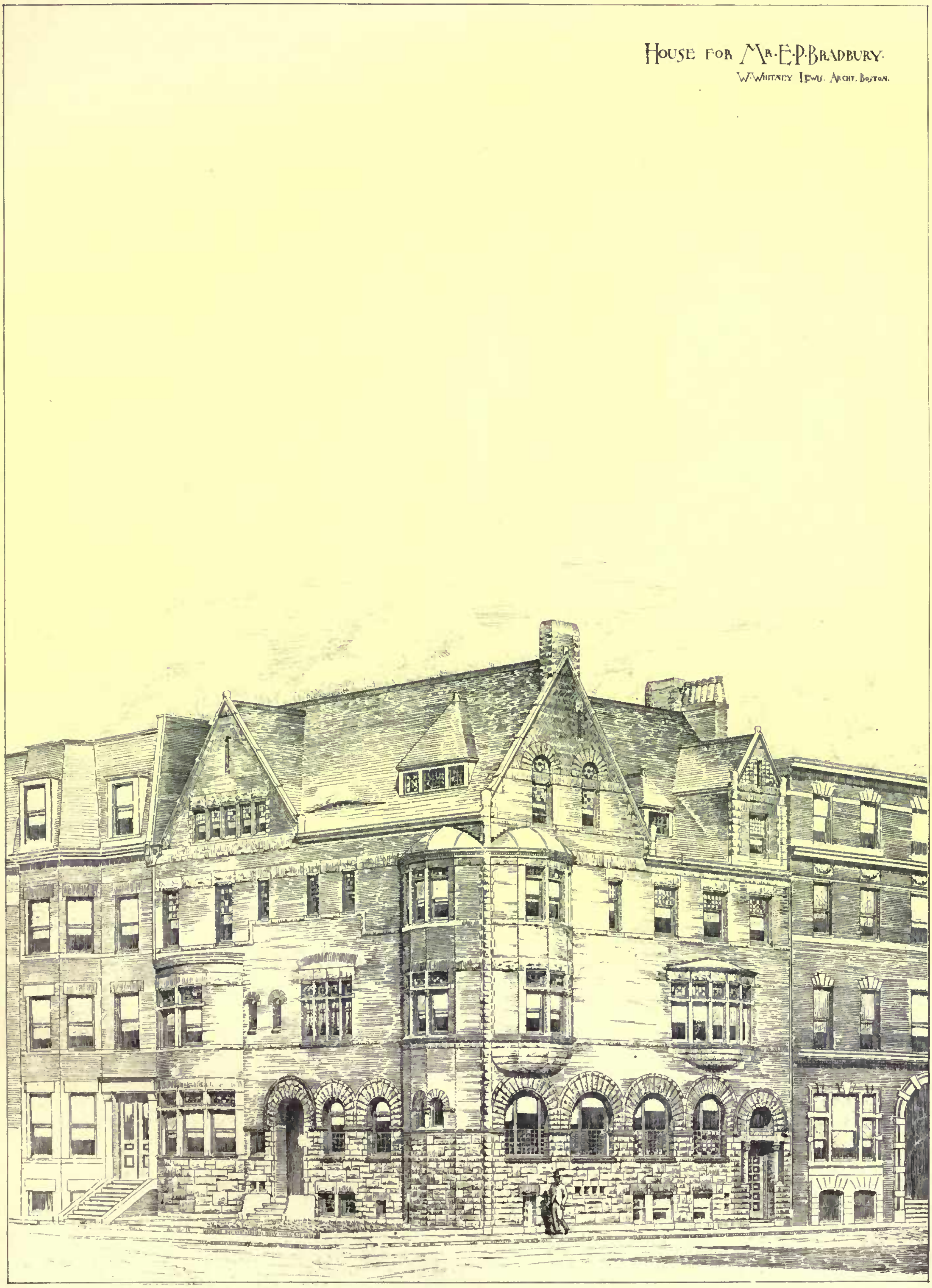


American Architect and Building News, Dec. 11 1886. No. 572



Heliotype Printing Co. Boston.

Old Colonial Work,



Heliotype Printing Co. Boston.

rapid. This admixture is effected preferably by means of a paddle-wheel mixer, the axis of which is at the water line of the well in which the mixing process is effected.

4. That after precipitation the defecated sewage should flow over an apron into a tank, which should be at least 4 ft. deep, and capable of holding at least one hour's sewage, and from this into a second tank over a weir placed half an inch below the surface and at the opposite end to the apron over which the sewage enters, this second tank being capable of holding at least four hours' sewage.

5. Or, if this continuous process be not adopted, the defecated sewage should then be allowed to remain at rest in a tank for at least one hour.

6. That the sludge should be removed in summer time once in 48 hours, and after removal be pressed, or otherwise consolidated, and dried with all reasonable speed.

The frequent removal of the sludge is a matter of importance. If this be not done, it putrefies, rises in large flakes, and promotes the decomposition of the supernatent water. It is not difficult by the operation of a dirty tank to undo all the good done by chemical treatment. It will be manifest that a double set of tanks is necessary for successful working.

[To be continued.]

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

HOUSE OF ELBRIDGE TORREY, ESQ., DORCHESTER, MASS. MESSRS. CABOT & CHANDLER, ARCHITECTS, BOSTON, MASS.

[Gelatine Print, issued only with the Imperial and Gelatine Editions.]

A VIEW of this house from the other side, plans, details and description were published in our issue of April 3, 1880.

HOUSE FOR H. Q. CLENEAY, NEAR CINCINNATI, O. MESSRS. BUDDEMEYER, PLYMPTON & TROWBRIDGE, ARCHITECTS, CINCINNATI, OHIO.

CAVAGNA FARM is about seven or eight miles from the city, and is situated upon the Cincinnati & Northern N. G. R. R. The house contains nine rooms besides bath and toilet rooms, laundry and drying-room in basement, and a thorough and complete system of drainage. The hall is the main feature of the house, and is finished entirely in oak, including floor, staircase, large fireplace, ceiling, etc. In extent it is 15′ x 29′, not including fireplace alcove, 11′ x 13′. Fireplace is built up and lined with salt-glazed, vitrified fire-brick, of a rustic-brown color, and contains a large hood, completely sheltering seats upon either side. All fireplaces are built of this brick, laid Flemish bond, and the hearths of same laid in herring-bone pattern. The hall ceiling is composed of the natural joists, with ornamental as well as efficient bridging, the panels being finished as the remainder of plastering of the house, in New Orleans beach-sand surfacing; flat tinting. The entire constructive parts of the building are of well seasoned Mississippi cypress, mortised, tenoned and pinned together, and all masonry of exterior, down even to the grade-line, to be finished in cement, having finishing coat broomed on with Ladd's Georgia buff lime. The roof to be of $\frac{3}{4}''$ thick tiles of shingle pattern hung on hardwood slats by means of a lug made on the tiles. The face of tiles are moulded roughly in sand, much after the manner of common brick, and have a deep rich, but modest red color. The hip and ridge tiles are of the same material, and are laid in and pointed up with Akron (N Y.) buff cement, "lined up" and joints reddened before the cement sets. The roof-work is to be done by a man who has made it his life business in Nuremberg, Germany. All metal-work to be done in heavy copper. The windows are to be glazed in leaded patterns, for the most part in clear glass, and finishing in style harmonious to the decorations of the various rooms in which they are placed. All the casement windows are to have heavy espagnolette bolts, constructed especially for them. The main rooms of house to be finished in cypress, and pine in attic. The cost complete is but little over $9,000. The contract is not let.

NEW NINTH NATIONAL BANK BUILDING, PHILADELPHIA, PA. MESSRS. HAZLEHURST & HUCKEL, ARCHITECTS, PHILADELPHIA, PA.

THIS building has a frontage of thirty-six feet and a depth of one hundred feet, and is located on the west side of Front Street, below Norris. The front is built of Indiana Lime Stone. Floors tiled and entire building fire-proof; side walls also are tiled to a height of six feet. The banking-room is forty feet high in the clear, and lighted from above through skylight. The rear is two stories high, and contains directors' room and dining-room, etc. The wood used for interior finish is cherry, and building is heated and ventilated by steam. The cost is about $40,000.

HOUSE OF E. P. BRADBURY, ESQ., BOSTON, MASS. MR. W. W. LEWIS, ARCHITECT, BOSTON, MASS.

OLD COLONIAL WORK — DETAILS FROM KING'S CHAPEL, BOSTON, MASS. MEASURED AND DRAWN BY MR. F. E. WALLIS, BOSTON, MASS.

HOUSE NEAR QUOGUE, LONG ISLAND, N. Y. MR. W. A. BATES, ARCHITECT, NEW YORK, N. Y.

EXPLORATIONS IN THE OHIO VALLEY.



COUPLET CAPITALS FROM THE CLOISTER VAISON.

THOSE who were interested in reading the republished account of the results of Professor Putnam's explorations in Ohio will probably feel equal pleasure in reading the following private letter which the *Boston Herald* publishes by permission. This letter shows that notable progress has been made in the few weeks' work of this season toward the solution of one of the most interesting archæological questions before the world — the character and habits of the people who built the various classes of mounds so numerous in the Mississippi Valley. No work of this kind in this country has been taken hold of so intelligently and systematically as this under the charge of Professor Putnam and Doctor Metz, and it should not be permitted to halt for lack of funds. Now, that the two hundred and fiftieth anniversary of Harvard is calling the attention of its friends to the opportunities for extending the usefulness of the institution by the application of their bounty, it may be well to remember that there is no department of the university more deserving of endowment than the Peabody Museum, which, with its future well provided for, would be in a position to do work which, if done at all, must be done quickly, or else suffer great and irreparable damage.

PEABODY MUSEUM CAMP, HAMILTON COUNTY, O., October 2, 1886.

My dear friend: — Since I wrote to you two weeks ago from our camp in Brown County, we have been here, and I have had such wonderful success that I can truly say a new chapter has been added to our archæological work in the valley of the Little Miami. First, you must know that our camp is pitched by the side of the great pile of earth we turned over in our explorations of the group of altar mounds on the land of Mr. Michael Turner. You will remember that we have been working, with occasional necessary intermissions, on this and the adjoining farm of Mr. Benjamin Marriott for the past five years, and that this is the place where we have discovered so much of interest within the great earthwork, of which the following is a sketch:

A hill through which two ditches, thirty feet deep, had been cut, separating the hill into three parts. Around the central portion a wall of earth had been raised, making a perfect circle five hundred and fifty feet in diameter. In this inclosure was a large mound, and near it a small one. These mounds, you will remember, proved of great interest, particularly the large one, with its stone wall four feet high, surrounding an altar of burnt clay. You will remember, also, that we found several human skeletons in the clay outside of the stone wall and two others on the wall, with various objects made of copper, shell and stone. The earth taken from the ditches was used to make the graded way from the top of the hill to the level land below. This graded way connects with an embankment of earth somewhat oval in shape and fifteen hundred feet in its greatest diameter, in which are two openings. Opposite the northern opening is an earth circle three hundred feet in diameter, and in this is a small mound which we have not yet explored. Opposite the eastern opening is a mound nine feet high. It was on this mound that we began our work at this place five years ago. At the foot of the graded way is a small circle enclosing a burial mound. North of this circle were two other burial mounds, and east of it was the great group of altar mounds, around each of which was a wall of stone four feet high, built below the surrounding level of the field. These mounds contained from one to seven altars, formed of clay, on which fierce fires had been made. It was in two of the basins of the altars in the mounds that I found the immense number of ornaments of various kinds, particularly of copper, the sixty thousand pearls, shells, beads, and other objects, also the wonderful little figures of terra-cotta, representing men and women. All these objects had been thrown into the fires upon the altars, evidently as sacrifices, or burnt offerings during an important ceremony. The thirty-seven pits with the singular tubes or "flues" connected with them; the concrete layer of gravel and iron over them; the singular structure of the great mound one hundred feet in diameter and twenty feet high; the great pit containing the many skulls, some of which had holes drilled in them, arranged around two skeletons placed in ashes, all serve to show that, connected with this group of mounds were extensive ceremonies of the deepest import to the people.

These extensive earthworks, made on such an elaborate scale, and containing evidence of the wealth of the builders, as well as of the ceremonial character of the works themselves, necessarily lead to

the conclusion that there must have been a large number of people connected with their construction. The beautiful location of this group of earthworks on the level second terrace which extends for miles in the fertile valley, and is surrounded by hills from which flow never-failing springs, indicate that in this region there must have been a large population; yet the few human remains that we found in the mounds within and without the encircling earth wall are not sufficient to meet the requirements. Such remains were probably those of distinguished persons, buried with special honors, but where were the other dead? Then, the many altars, or basins of burned clay which, evidently, had been used over and over again, and were, with two exceptions, empty when the mounds were erected over them, are indications of cremation, and yet, where were the burnt human remains? Cremation in open fires will, necessarily, leave many fragments of calcined bones with the ashes, unless such remains are burnt over and over again, and special pains taken to reduce all to ashes, and yet we had found, in a niche of the stone wall about the large altar mound, the burnt bones and ashes of but one individual. If these altars were the places where cremation took place, what, then, had become of the remains? These were questions which Dr. Metz and myself often asked of each other, and we felt confident that somewhere near by there must be a general burial-place for the common dead, and many a hunt was made for surface indications. On the north and south sides of Mr. Turner's barn and west of the large circle, are two scarcely-perceptible ridges (O. P.) similar to other slight irregularities here and there over the field. Owing to the cultivating of this place for many years, and to the tramping of cattle in the barnyard, these ridges have been more or less worn down, and a few water-worn stones have been exposed on the surface. These were first noticed by Dr. Metz about a year ago. As soon as our camp was pitched we took a look at these water-worn stones. They were fragments of limestone filled with fossils of the silurian age, lying on a deposit of gravel over which, long ago, had flowed the waters of the Little Miami. What more could these stones have said, had they been endowed with speech, than that which was evident to our eyes: "We were long ago brought here by men." Here, then, was something more to be revealed in connection with the history of these great earthworks of an ancient race, and here we would dig a trench on the morrow. We started our trench sixty feet west from the wall of the circle, and well outside of the slightly-elevated portion, which, we were afterwards told by Mr. Snyder, who remembers the place fifty years ago, was formerly much more marked, and had the appearance of a long, low mound. Digging down to the hard pan, we carried our trench westward for about ten feet, when we came to three large water-worn stones regularly arranged, side by side, in the gravel hard pan. It is necessary for you to fully understand the character of the earth in which we were working in order to appreciate the labors of the ancient people at this place, and I may well add our own, in making these researches. First, the surface consists of a few inches of dark soil overlying from eight to ten inches of clay. Under this clay is a layer of coarse gravel, containing many pebbles, some of considerable size, but all colored and firmly cemented by an amount of iron which, from some natural cause, is far in excess of that in the gravel all about. This iron-cemented gravel forms an irregular layer of from one to four feet in depth, and under it is a loose, uncolored gravel mixed with sand, which, judging from a pit near by, is certainly thirty feet in depth, and probably much more. It may be that this is part of the great terminal glacial moraine which Professor Wright has been tracing across the state of Ohio. In this iron gravel the stones we found were imbedded. On cleaning off these stones we found that there were others at right angles to them, and soon we made out that we had at last discovered a grave. Would it prove to have any connection with the people who built the earthworks and the altar mounds? Our hopes were great and they were soon to be realized as far as one grave could tell its story. On carefully removing the earth from the eastern end of the grave, close to the stones, we discovered the toe bones of a human skeleton, and, after several hours of the hardest kind of trowel-digging, we had the satisfaction of exposing the skeleton lying at full length on its back. Its skull, slightly turned to the right, rested on a flat stone at the western end of the grave. On the left side of the skull was a large sea shell of the genus Busycon, from which the central portion had been removed, a common method of making vessels among the various peoples of America, and often found in burial-mounds and graves from the Gulf States to Michigan. With the bones of the neck were several shell-beads, also of a common form, and as widely distributed over the country as the Busycon shells. The arms were extended at full length along each side, and enclosed by the bones of each hand, resting on the hips, was a spool-shaped ornament (which our explorations have proved to be ear-ornaments), made of copper, and like those found with several of the skeletons in the mounds of this group, and the large number found on the altar in the great mound of the group. We have, at the Museum, ear-ornaments of this character, from burial-mounds in various parts of Ohio and west to the Mississippi in Illinois, and from Central Tennessee, but I have never found them in any of the several thousand stone graves of the Cumberland Valley, which I have explored, nor have we found a trace of them among the several thousand graves associated with the singular ash-pits in the cemeteries which we have explored in the Little Miami Valley, nor with the skeletons buried in the stone mounds, nor in many of the simple burial-mounds of Ohio. They seem to be particularly associated with the remains of a people who practised cremation to some extent, and who built many of the great earthworks of the Ohio Valley. That it is an ancient form of ornament, made from native copper, there can be no doubt, although they may have been made also by the descendants of conquerors of this people in later times; and it is not at all improbable that the form of the ornament may have survived in the time of contact of the "red race" with the white. I can only say that, in all the recent Indian graves I have opened or know about, this peculiar character of ornament has not been found; and if they were ever made by the whites and furnished to the Indians, I have never happened to find any that showed evidence of the fact. We have certainly found them under such conditions in Ohio that they must have been buried with their owners long before the discovery of America. Then, again, all we have found have been made by hammering pieces of native copper, and not by casting the metal.

By the side of the right tibia of the skeleton in the grave was a copper pin, a wooden bead covered with thin copper, a few long, slender flakes of flint, and a fragment of some kind of an ornament made of shell. These long flint knives are of the same shape and character as the well-known obsidian flakes from Mexico, and we have found them, as a rule, associated with copper ear-ornaments like those in this grave. They are sharp-edged, and are as good knives as the Mexican flakes. While speaking of them in general terms as flint, they are in reality flakes struck from several varieties of stone, many of them being of a bright-red jasper and others of chalcedony. The wooden bead covered with copper is of the same character as others we have taken from the burial-mounds in which we have found the copper ear-ornaments. Close to the right hand and hip, but two inches above them, and covering a space a foot in diameter, were a mass of fragments of burnt human bones, with bits of charcoal mixed with ashes. These remains of a cremated body had been gathered from the place where it had been burnt, brought to this grave and placed by the side of the body at the time it was laid in the grave. The close contact of the remains to the finger-bones of the skeleton, which were not disturbed, was sufficient evidence of this. Here, then, in one grave, we had found the evidence associating it with the altar-mounds and the rest of the earthworks about, independently of the fact that the grave itself was within the earth-wall surrounding all the other works. We had found, evidently, the burial-place of the people, and this was abundantly confirmed as our work progressed.

We have now for two weeks been engaged in exploring this burial-place, and during this time we have discovered eighteen graves, four large, deep pits, and several holes dug in the gravel, as well as places where there had been fires, and numerous other interesting facts, many of which, by themselves, would be trivial, but which, when they are all put together, will give a far better idea of the customs and works of the people who made the great earthworks in Ohio than it has been possible heretofore to obtain. All other explorations in the State have been fragmentary. No other systematic work has been attempted, and hence we have had plenty of theories built upon partial facts. We have much to do before the exploration is completed even of this single group. The question is, simply, will friends help us to pay the cost. With money for this purpose, we shall be able to continue these important researches. So far, generous friends have supplied it, and all we can do is to work on as long as possible and hope for further aid.

To give you a detailed account of all we have found during these two weeks would, I fear, draw too much on your patience, notwithstanding your great interest in the work, and I shall only call your attention now to a few of the more interesting points. Of several of the graves, Mr. Kimball has taken photographs, and when they are printed you will obtain a better idea of the graves than from any description I can give. Individuality had its exemplification in this old cemetery, the same as it has in our modern ones, and the modifications are so great that no two of the graves thus far discovered are alike. In one instance there were no stones about the skeleton; in another a carefully-built wall had been made of long, narrow, flat stones, and a regular wall, four layers high, had been made in the same way that a mason lays bricks, but without mortar. In some graves flat stones were placed at the bottom; in others the skeleton was firmly embedded in the gravel, while in one the body had been placed in a thin layer of clay placed over the gravel. In one grave there were two skeletons, one extended at full length on its back, and the other crowded into the grave by the side of the right leg of the first. A child was placed in a small circular grave, the body having been so arranged that the head and the feet were not far apart. Most of the graves were comparatively shallow, extending from six inches to a foot into the layer of gravel. The deeper the grave the better the condition of the skeleton. One grave was dug to the depth of nearly four feet in the gravel, and was seven feet long by four in width. At the bottom was a pavement of flat stones, forty-nine in number. On these stones the body had been extended, and the grave had been filled up with over three hundred stones, all of which had been brought from the river-bed, nearly a quarter of a mile distant. Over these stones six inches of gravel had been placed, around and over which other stones had been regularly arranged. The free percolation of water through the stones had filled up the grave and caused the skeleton to decay, only a few fragments being left. The graves were not covered with large stones, as is the case with the stone graves of Tennessee, and there is but little in common between

the two. Another class of graves were basin-shaped, small in size, and carefully made of flat stones. In them we found burnt human bones and ashes. In one was a pipe carved from stone, which had been burnt with the body, and, in another, were fragments of a burnt copper ornament.

I must give you an account of the graves which were of particular interest. Grave No. 5 in our note-book was six feet six inches long, two feet nine inches wide, and one foot eight inches deep, measured from top of the stones. It was made with care, and the stones were carefully placed so as to form a substantial wall. The bottom was completely covered by four large, flat stones, on which the skeleton lay on its back. The skull was at the east end of the grave. When the body was put in the grave the knees were drawn up, the left hand rested on the body, and the right was laid straight along the side. The result was that the bones of the left hand were found in close contact with the upper ends of the tibia, which had fallen down between the femora. In the bones of each hand was a copper ear-ornament like those I have mentioned. In the corner of the grave, near the bones of the left foot, was a large sea-shell, from which the central portion had been cut away. Near this was a little cup carved out of stone, two canine teeth of a bear, each with lateral perforations, and in each tooth was the chalky remnant of a large pearl. Close to them was a large crystal of galena, and a knife made of a long flake of flint. On the same side of the grave, nearly opposite to the shoulder and partly under the side stones, were eight of the copper ear-ornaments in a bunch, and under them a long bone point. We did not discover them until we had taken out the skeleton and began to remove the stones, for it is our rule always to remove everything placed by human hands, and to turn over every inch of dirt previously disturbed. On taking up the flat stones, which were firmly imbedded in the gravel, and had their edges covered by the side stones, we found the following articles, which must have been placed where we found them before the stones had been put down. Under the second stone (there was nothing under the first) near the centre was a copper bead and small thin pieces of iron, probably meteoric, but it has not been analyzed, and it may prove to be bog-iron which has formed in that place. As we have found several ornaments made of meteoric-iron on the altars of the mounds in this group, as well as two good-sized pieces of an iron meteorite, I strongly suspect that this iron will prove to be the same. Under the third stone were two discs or halves of a copper ear-ornament. These were several inches apart, and must have been so placed when the stone was put down. Near these was a wooden bead, with a thin covering of copper. Under the next, or fourth stone, were several of the long flint flakes or knives, and eight inches from the edge of the stone was a small copper celt. These deposits, under the stones of which the body was to be placed, certainly suggests the offerings of friends at the time the grave was prepared, and the various other objects placed in the grave with the body can, with equal reason, be looked upon as the property of the deceased, or as friendly offerings. At all events, they are important as proof that the individual buried here belonged to the people who built the mounds, as these several objects are of the same character as the many we have found on the altars, and with the few skeletons in the burial-mounds of the group.

Grave 15 of our notes was remarkable for the care with which the walls, sixteen inches high at the head and foot, were made of four layers of flat stones, while along the sides, in the clay above the gravel layer, were simply a row of stones. The skeleton was lying firmly imbedded in the gravel, extended at full length on its back, with the skull at the west end of the grave, while the toe bones were against the opposite stones. The skeleton thus extended the full length of the grave, which was six feet three inches. As with nearly all the adult skeletons, there was a copper ear-ornament in the bones of each hand. On the breast bone was a copper band. At the neck were two shell beads, and near the left shoulder was a flake knife. A few inches from the left foot were about twenty of the long flake knives, carefully laid together, as if they had been wrapped in a piece of skin or cloth when placed in the grave.

With two other skeletons we found celts made of soft coal. These were perfectly made, with fine, smooth edges and polished surfaces, in exact imitation of the ordinary stone celt or hatchet; but, as they would have been worthless for the uses to which stone celts were put, it is likely that they were ornamental or ceremonial objects.

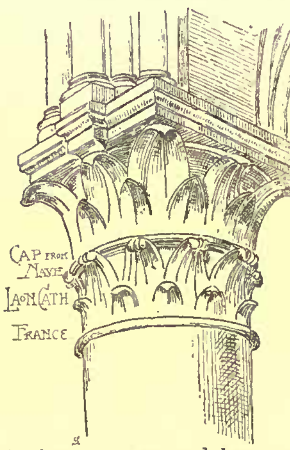
I will allude only to one more grave, No. 18, of our notes. This was marked by a mass of gravel a little over seven feet long and nearly three feet in width, around the edges of which were small stones eight to twelve inches long. This mass stood up eight inches from the gravel layer under the clay. Removing these stones and gravel we found loose gravel filling a pit just seven feet long and three feet four inches wide. At the depth of two feet we came to hard undisturbed gravel, and on this was a human skeleton extended at full length on its back, with the skull at the southeast end of the grave. The bones were firmly embedded in the gravel, and so dry that great care was necessary in removing this matrix. However, after six hours of unremitted labor with small trowel and brush, they, and the several objects associated with them, were all uncovered and left in place, even to the finger and toe bones, and a photograph was taken showing everything in place. In each hand was one of the copper ear-ornaments of the kind I have referred to so often. The finger bones were so arranged as to show that these ornaments had been clasped in the hands at the time of the burial of the body. Another of these ornaments was on the neck bones in contact with the under jaw. On each side of the copper ornament was a canine tooth of a bear, with the lateral perforations. Partly over the bear's tooth, on the left side, was a piece of native copper, which had been hammered roughly into a flat, thick, irregular sheet. This is without holes, and is probably an unfinished ornament. Above this, and close to the skull, was a small copper cone, like many found on the altar of the great mound. Near the right shoulder was a large sea-shell like the others I have mentioned. This skeleton, as it lay in the grave, measured five feet ten inches from the top of the skull to the top of the great toe, and the individual was not far from five feet four inches in height when living. With the exception of a portion of the sacrum, which had entirely disappeared, this skeleton was taken out in a perfect condition. The decay of the sacrum was owing, probably, to the fact that a small round stone had fallen in such a way as to allow water to percolate around it.

This skeleton is a good illustration of the absurdity of the common notion that as soon as skeletons, which have long been buried are exposed to the air they fall to dust. I always have a quiet laugh when I read notices of that kind, and you may put all such accounts down to the inexperience and clumsy work of the persons removing the skeleton. The fact is that it requires great care to remove the earth from about the bones, and very few persons will take the time to do it properly. As soon as a bone is uncovered most persons attempt to remove it at once, and, of course, it goes to pieces. Now, if a skeleton is in dry earth or gravel, and is very dry and crumbling, the proper mode of procedure is to uncover the bones with great care, loosening the earth with the point of a small, flat trowel and removing it from the bones by means of a small broom, or clothes-brush, then let the moist air come in contact with the bone, or, if the air is very dry and hot, sprinkle the bones with water and let them absorb all they will. In this way the particles of bone swell and interlock, and, after a while, the bone can be safely taken up by avoiding force in removing it from the earth. In case the bones are in a wet clay or earth the matrix must be removed with great care. In such cases the bones are soft and spongy, and they must be allowed to remain in place until they have dried off; but they must not be exposed to the full heat of the sun, otherwise they will crack and splinter as they dry. Of course, instances often occur where we find only minute fragments of a skeleton in a grave, all the rest having passed through a chemical change and been reduced to its earthly particles; but that every bone found in a grave can be preserved by using proper care I know from long experience to be the case. I may also call your attention to the fact that the state of perfection of the skeleton, outside of certain limits, is not evidence, by itself, of the antiquity of the bones, as the conditions of burial, as well as the character of the bones, must be taken into account.

In our exploration of this burial-place we found there three large pits, which were covered with gravel and stones, like the grave I have just described. These pits had been dug through the compact iron-cemented gravel below the clay, even to the depth of five feet, and all the material taken from them had been carried away. The pits were then filled with ashes and burned earth, and covered with several inches of gravel and stones, like a grave. The sides of the pit were not burned, so it was evident that the ashes were not from fires on the spot. There were several places uncovered by our excavations near these pits or graves where fires had been made on the clay or gravel, but the ashes had been removed, and hence it is probable that they had been put in these carefully marked pits. But what had become of the gravel taken from them?

You will remember that in the great mound of the group of altar mounds, there was a layer of gravel two or three inches thick, which we have called the concrete layer. This gravel was cemented by a large amount of iron, and it has been a puzzle where the iron came from. It was far too great in amount to have been derived from the clay in the mound above, and, besides, the gravel of the same layer about the edges was loose and light without any mixture of iron. Now, this iron gravel from the burial place is of the same character as that forming the concrete layer in the mound, and it, therefore, seems probable that these pits must have been dug for the purpose of obtaining it. As this gravel had been used during the extensive ceremonies which must have taken place at the time the mound was constructed, the very place from which it was taken seems to have been held sacred, and the pits, therefore, filled with burnt material, covered over and marked in the same manner as some of the graves. This again, is further evidence of the connection of the burial place and the ceremonies which took place there with the altar mounds. The more we examine into the details of this wonderful group of ancient works, the more interesting and instructive they become. We have already spread before us the outlines of a grand picture of the singular ceremonies connected with the religious and mortuary customs of a strange people. There are still some touches to be given before the picture is complete, but it is more perfect than any other that has been drawn, and as our work goes on, we may yet be able to fill it out, and finally present it as a perfect whole. Unfortunately, other duties call me home at once, and for some months I shall not be able to give personal supervision to the work, but it will be continued under the direction of Dr. Metz so long as the money in hand holds out. Will more be forthcoming to enable us to keep on to the end? Friends to the cause of American archæology must answer this. On my way home, I shall visit the serpent mound again, and will try and write to you from that wonderful monument of an ancient race. Yours very truly, F. W. PUTNAM.

SO-CALLED BRIBERY OF ARCHITECTS.



SEVERAL weeks ago we received from several architects in New York and Boston copies of a circular issued by a business firm which, although it was headed "confidential," did not appear to be one of those flagrant attempts at corruption which we are willing to expose, but rather an offer of a trade discount such as business houses may and do issue every day without departing in any particular from the strict path of mercantile morality. As we had done in other cases, we addressed a letter to the firm explaining the peculiar attitude of an architect as toward his client, and giving them an opportunity to withdraw the circular or explain their real meaning. They have chosen the latter course, and have sent us the following statement, which we trust will be as satisfactory to the architects who lodged their complaints in our hands — and whose nice sense of propriety we cannot too much applaud — as it is to ours:

New York, November 19, 1886.

To the Editors of the American Architect: —

Dear Sirs, — Your favor of the 15th to hand, and contents carefully noted.

In regard to our "confidential" circular issued to architects, would state that we have issued quite a number of them to architects in New York and Brooklyn, not, however, with the slightest "evil intent," or with the idea of "corrupting" any one. The whole matter is simply this, the construction of our rail requires that they be made in sizes to fit each particular opening, therefore, it is almost impossible for hardware men to keep a supply of them on hand, and they simply order them from us when they have a positive order for some. And we know of a great many instances where our rail has been called for in specifications, and when a hardware-dealer or his agent figures on a job, he has, in many instances, tried to work off either the common floor-rail or some patent hanger that he has in stock, and very often does not hesitate to misrepresent our rail, and say it is no good, and even says he knew of cases where it was put in and had to be taken out because it did not work.

We have worked very hard to try to get this rail introduced here, and it has cost us a great deal of money, and the results thus far in a pecuniary way are not gratifying, although in every instance the rail has, as far as we can learn, given entire satisfaction. In some cases, where we heard the rail did not work well, we found it was caused, at times, by a wanton disregard of the directions given for laying same, or plaster was allowed to cover it up, and then the rail was blamed. In every case we looked into the matter and rectified the error of others and made everything all right. In offering a commission of ten per cent to the architects on such a thing as this, it would show a very poor conception of their integrity, if it was offered as a bribe, but we know that in many instances the hardware is ordered direct, and the architects wish to save as much for their client as they possibly can, and in offering this commission or discount, we wished to get on the track of places where our rail was to be used, so that when it went in we could follow it up and know that it *worked* satisfactorily. This is entirely separate and distinct from our trade discount, and we did it simply to find out where our rails were located, so that we can *know* they work properly.

The writer knows, from personal experience with several architects, that they are on the war-path about this very circular, but when the matter has been explained to them in the manner in which I have just written, that they are satisfied with their explanation. We have too much at stake, and value our reputation too highly to attempt to bribe any one. If we were furnishing a material that was in the open market, and offered a commission that the contract was to be given to us, it might be assumed that we offered a bribe, and it might lay the party accepting same open to this belief, but it is not so.

We simply wish to get a check on these persons who try and spoil the sale of our rails. We adopt this method after long consideration, and after conferring with parties whom we believe are in a condition to know.

We thank you for your kind consideration in this matter, and assuring you that we appreciate your kindness, remain, Yours truly,

George T. Taylor, *General Agent.*

We believe that the Boston firm of gas-fitters who issued a somewhat similar circular which, to our minds, merely offers a rebate that the architect can secure for his client, is a straightforward business proposition which does not contain the essential essence of bribery, and so do not hold them up to scorn as we have been asked to do.

SOCIETIES

ENGINEERS' CLUB OF PHILADELPHIA.

At the meeting held November 6, 1886, Mr. Frank A. Hill presented a paper upon Accidents in Anthracite Mines.

The impression that the proportion of fatal accidents in the anthracite mines is increasing, which has grown from the occurrence of recent disasters, is incorrect.

The duty of the mining engineer and superintendent is to obtain the greatest yield at the least cost of money and life. The possible yield is more than the market can absorb, and the reduced cost of the coal at the mines shows the improvement in the economy of mining, but this has not been accomplished at the expense of the lives of the miners. From 1875 to 1880 (six years) there was an average of one death for every 98,662 tons mined, while from 1881 to 1885 (five years), the average was one death for every 105,879 tons mined. This improvement is in the face of increased danger from gases, mine-fires, roof-falls, quicksand, water, additional machinery, etc.

Roof-falls kill forty-four per cent of those who lose their lives in the mines.

Carelessness of the men is the greatest danger and the one hardest to meet. The importation of unskilled foreign labor joins ignorance with carelessness in swelling the death-rate. Roof-falls, explosions of fire-damp, and careless handling of powder, furnish at least sixty per cent of the deaths. In almost every case these accidents are due to the carelessness of the men; ten per cent is a very high estimate of the accidents for which officials are responsible.

From 1875 to 1885 (eleven years) in Great Britain the average number of tons mined to one life lost was 130,555; in the anthracite region of Pennsylvania, 102,608.

There are no breakers in England, and as we waste in the breaker one-third of the material hoisted from the mine, fifty per cent should be added to the shipment to obtain our true production. The English miner uses about one-fifteenth as much powder as the anthracite miner, so that fourteen-fifteenths of the accidents from powder, as well as all accidents in the breaker, must be eliminated in a fair comparison. With these corrections made, the average number of tons mined in the Pennsylvania anthracite mines was 181,252 tons per one life lost, as against 130,555 in Great Britain.

The Secretary presented, for Mr. Herman Haupt, Jr., a description of the St. Paul Ice Palace, illustrated by photographs and prints. The structure was of rectangular cruciform ground plan, 180 feet by 154 feet, with principal tower 106 feet high, surrounded by other towers, etc., giving very beautiful and complete architectural character to the building. The principal entrance was under a Gothic arch of 10 feet span and 25 feet high. The blocks of which the palace was constructed were 22 inches by 44 inches by 20 inches, the latter being the thickness of ice. They were marked out on the surface of the ice on the Mississippi River, and sawed at once to these dimensions, which were unchanged afterwards, except where, in round towers, etc., some trimming with axes was required. The blocks were raised in place by ice-tongs and tackle, operated by horse-power. The blocks in walls and arches were cemented with water, which, at the existing temperature, froze almost immediately. The structure was reared in about forty-two days. It was the conception of Mr. George Thompson, of St. Paul.

Howard Murphy, *Secretary and Treasurer.*

COMMUNICATIONS

MILL-FLOORS.

December 4, 1886.

To the Editors of the American Architect: —

Dear Sirs, — I have read the rejoinder of C. to my treatment of the question of mill floors with much interest. I anticipated the reply that the present Building Act appeared to require the longitudinal girder to which I have taken exception. If this requirement exists in fact, it may be one of the few faults in an otherwise excellent building law. My observation of the use of this girder has been limited to buildings which are not intended for heavy storage, which can hardly be put to that use in any event, and which might therefore be treated rightly on a lower factor of safety than that which would be required for a warehouse subject to contain very heavy merchandise.

C will observe that Mr. Woodbury made use of a factor-of-safety of 6, upon a modulus of rupture considerably higher than is given in Trautwine. I am without the necessary technical knowledge either of mathematics or of construction which would enable me to pass upon a question as to the relative merits of the different methods of computation; but the conclusion which I have derived from Mr. Woodbury's treatment of the subject of mill floors in his treatise upon the subject, and also from other experience and sustaining evidence of mill-engineers, is that so far as the floor frame is concerned, the mill-construction could be adapted to all the ordinary purposes of storage as safely as the ordinary joist construction, 12 to 24 inch on centres, without the longitudinal girder.

This is a point which might well be made a subject of discussion among experts. According to Mr. Woodbury's investigations, the following goods would require to be packed ten feet high in order to bring the weights named upon each square foot of floor. I have selected the heaviest articles of customary storage:

East India wool	280 lbs.
The heaviest woollen flannels in cases or bales	220 "

Compressed cotton	250 lbs.
Jute lashings (whatever they may be)	430 "
Heavily sized cotton tickings	370 "
Wheat in bags	390 "
Brown sugar in boxes	450 "

Among the articles which would weigh more per square foot, if piled ten feet high, may be named

Soda ash	620 lbs.
English cement	730 "

but these articles would never be piled so high, or very rarely, inside a warehouse except upon a basement floor.

The articles which might require special consideration would be

Super-calendered book-paper	690 lbs.
Glass	600 "
Tin plates in boxes	2,780 "

these latter articles being in somewhat small packages may be piled very high by hand without putting too much work into the piling.

Are the warehouses in Boston of the ordinary construction built for miscellaneous purposes, consistent with the factor made use of by Mr. Woodbury when built to carry customary loads, and not for special purposes? If they are not constructed on these conditions, is the joisted floor with the longitudinal girder of necessity adopted in place of mill construction of a heavy kind?

The fact is mentioned by C. that if heavy timbers are placed 10 feet apart, 4-inch plank would be required for the main floor; and this would, perhaps, cost more than the ordinary method of flooring.

But there are other reasons than strength for the adoption of the 4-inch floor; it is more *slow-burning;* this point comes in for consideration at the present time, when the necessity has been forced upon owners by the advance in the rates of insurance to avoid combustible architecture, thereby giving architects an opportunity which they never had before to present suitable plans.

We consider the best construction for factory purposes to be spans not exceeding twenty feet in length for the timbers, and spaces not exceeding eight feet on centres. This brings the posts eight feet apart; I am well aware that owners greatly object to the proximity of posts. But herein again comes in the factor-of-safety from fire, especially if iron posts are made use of, subject to be destroyed at very short notice by the heat of a very moderate fire. In this consideration again the skilful architect may have an opportunity to prove to owners in which direction their true interests lie, now that the stock underwriters have undertaken *prevention of loss by fire*, in addition to their previous functions.

I trust that this sort of criticism may not be considered officious. The experience of the mutual underwriters is mainly limited to factory buildings in which the loads are light, as has been previously stated; but when they witness the extremely profitable results of the system of preventing fire in factories, it is difficult for them not to hanker a little for the control and direction of other property which they cannot now insure, in order that they might try their own hands in stopping wasteful destruction.

The gain to a textile manufacturer during the past thirty-five years (the life of the Mutual Insurance Company, of which the undersigned is president), as compared to other methods of insurance, has been this: that the actual dividends which have been returned to the members of this company in thirty-five years, if made use of by the manufacturers in their business at six per cent annual interest throughout the period, will have saved to them in thirty-five years, very nearly, if not quite the entire value of the property now insured in their names, which could have been destroyed by a fire, causing a total loss of everything combustible upon the premises, including building, machinery, stock and goods.

Æsthetically considered, is not the mill floor to be greatly preferred to the naked joists or to the plastered ceiling?

EDWARD ATKINSON.

THE MANHATTAN STORAGE WAREHOUSE PLATE.

BALTIMORE, MD., November 29, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — Will you inform me what the building is, and what streets it is the corner of — the one shown on the extreme right, in your gelatine print of the Manhattan Storage Warehouse, *American Architect* of November 27, and oblige

W. CLAUDE FREDERIC, Architect,

[WE believe it is an extension or an independent adjunct of the Grand Central Depot on Forty-second St.—EDS. AMERICAN ARCHITECT.]

THE RIGHT TO REJECT BIDS.

INDIANAPOLIS, IND., December 1, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — A private corporation advertise for bids on an important structure in the usual form "reserving the right to reject any and all bids." The sealed bids are opened in private by the company's officers, the terms of the bids are not made public, and the contract awarded to one of the bidders, who agrees with the company not to allow the amount of his bid to be known. What are the rights of bidders under such circumstances, and what remedy, if any, has the lowest bidder among those shut out, granting him to be solvent and capable, and his proposed bondsmen above criticism?

Very respectfully, A CONTRACTOR.

[THE bidders have no claim to know the amount of the accepted tender, if the parties immediately interested wish to keep it to themselves, nor has the lowest, or any other bidder, under the conditions of the bidding, a right to insist upon the acceptance of his offer. The reservation made in the advertisement that the company should have the right to reject any and all bids makes this clear, but even where no stipulation of this kind is made it has been repeatedly decided that the party inviting bids has a right to consider other circumstances besides the relative amount of the tenders, and to accept the one which seems, on the whole, most advantageous for him. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

GIGANTIC STATUES OF BUDDHA. — The statue of Liberty just inaugurated at New York, says the *Daily News*, is described as towering "to the skies above all known statues of the present and the past," and as "the Great Eastern of statues." The writer may be excused for not knowing that a much higher statue exists, and has long existed in Afghanistan. . . . These statues are on the principal road between Cabul and Balkh, at a locality known as Bamian. At that place the road passes through valleys, with high scarped cliffs of conglomerate. Probably about the early centuries of the Christian era the Buddhists excavated numerous caves, as monasteries for themselves, in the rock of these valleys. These ancient excavations still exist, and can be counted by thousands. In addition to these, a number of statues of Buddha were cut out of the solid rock. Two, at least, are still standing, and the largest was measured by Captain Talbot with the theodolite; so that we now know the height to at least a few inches. The measurement gave it as 173 feet high; that is rather more by a few inches than the Nelson Column in Trafalgar Square, and nearly 70 feet higher than the New York figure. This figure of Buddha is the real "Great Eastern" of statues. The celebrated Memnon statues of Egypt would only come up to the knee of this mighty *ikon.* At Bamian there is another figure of Buddha, 120 feet high. These are erect standing figures; there is also a sitting figure about 30 feet high, There are the remains of two other figures, but they are in a ruinous condition — one of them is estimated to have been about 50 or 60 feet. These statues were originally, we know, either gilt or covered with metal. The Chinese Pilgrim, Hiouen Thsang, passed the spot in the first half of the seventh century, A. D., and from him we have a description of the two largest figures as they existed at that date. The statues have, of course, suffered from time. Armies have often passed by the road. Genghiz Khan and Timur-Lung's hosts did so, but they had only bows and arrows to throw at the idols. In later times Mohammedan soldiers have passed with artillery, and in their hatred of "Bhuts" or idols they fired solid shot. The idols have, thanks to their great size, stood this treatment very fairly, and, in spite of it the true character of the figures, as well as the art style to which they belong, is still faithfully preserved. — *From a letter to the London Daily News.*

THE CITY OF RHODES. — The city of Rhodes is situated close to the northernmost extremity of the island, facing the mainland, with a north-eastern aspect. In front of it are three harbors, which were originally separated from one another by small spits of land; but these were subsequently improved and strengthened by moles so as to afford protection against the sea. From the shore the ground rises gradually in the form of an ancient theatre, the highest point being towards the West, where it overlooks the sea in the opposite direction. This hill — which now bears the name of Mount Smith, because the house that stands on its summit was the residence of Sir Sidney Smith in 1802, at the time of Napoleon's Egyptian expedition — was the position of the ancient acropolis. But it is by no means a commanding height, and this is probably the reason why no city was built here at an early period; for this site was unoccupied until towards the close of the Peloponnesian War (B. C. 408), when the inhabitants of the three leading cities of the island, Lindos, Ialysos, and Cameiros, agreed to abandon their homes and found a city in common. In other respects the position is admirable for a commercial station on account of its harbors, its nearness to the mainland, and its being a natural point of departure for Egypt and the East. The later glories of the place, when it became the stronghold of the Knights of St. John, and one of the bulwarks of Christian Europe against the Ottomans at the height of their power, have almost eclipsed its ancient fame. Yet Strabo speaks of its grandeur as being surpassed by no other city, and hardly equalled by any (xiv. 2, § 5, p. 652). Its commerce, its political institutions, its school of oratory, and its school of sculpture, enjoyed a world-wide renown. Its strength was so great that it endured a siege by Demetrius Poliorcetes in B. C. 304 and triumphantly repulsed him, though he brought all his force against it for the space of a year. Nor can we forget that it became the residence of many great men; that Cicero studied there, and that Tiberius chose it as his place of voluntary exile. Of the magnificence of that time little remains beyond the Hellenic foundations of the moles and the numerous sepulchral monuments of gray marble — resembling small round altars or pedestals of statues which are met with in the city and the suburbs. But, as a specimen of a mediæval fortress the existing city is almost unrivalled; and the objects that remain there, notwithstanding the ravages of time, illustrate in an impressive manner the organization of the Order of the Knights of St. John. The enormous moat, wide and deep, and faced on both sides with stone; the solid walls, with towers at intervals, forming sometimes a double, and at the highest point, where the palace of the Grand Master stood, a triple line of defence, and drawn in a horse-shoe form over the sloping heights from either side of the central harbor, and along the line of the harbor itself;

and the fortifications by which the moles themselves were protected — all remain unchanged to attest the strength of this bulwark, on which, for centuries, the attacks of its powerful foes broke in vain. — *H. F. Tozer, in the Academy.*

Air from a Cave for House-cooling. — I wish your opinion upon a matter in which I am much interested. Grand Avenue cave, situated four miles from Mammouth cave, contains some nine miles of avenues filled with delightfully cool, pure, dry air; temperature 55°. I propose to erect a house immediately over this cave; make the outside walls and partitions all hollow, so that they may communicate with a cellar, which shall be connected with the cave by a large shaft, say eight feet square. The question is, will the air between the house and cave take the temperature of the cave by diffusion or otherwise, or will it be necessary to use mechanical means to get the air into the building? I have seen and spoken to several scientific men on the subject, who agree with me that an interchange of air will take place and continue until equilibrium is restored by making the temperatures the same. It is proposed to erect a hotel for a cool-air summer resort, and also for a sanitarium. If you think proper, I would like you to put this before the readers of your valuable periodical, and get the benefit of their opinions. It is a matter of some scientific interest, in which physicists, geologists, and sanitarians may be interested. — —*M. H. Crump, in Science.*

Suffocation in Wells. — A painful story of death from misadventure, which in this, as in so many other cases, means death from ignorance or carelessness, was investigated the other day by Dr. Danford Thomas. A prisoner in Pentonville Goal volunteered, with a colleague, to descend a disused well for the purpose of removing pumps. The danger of such a proceeding is manifest, and it is reported that the authorities were warned of the danger, and the jury certainly appended a censure to their verdict. One of the men died, and the other was so much affected that he had to go to a hospital. It is scarcely necessary to remind our readers that the utmost caution should be used before entering any well or confined space. Carbonic acid generates under a variety of conditions, and its action, even in small quantity, is not only poisonous, but paralyzing. The candle test is, when properly used, sufficient. If the candle burns clear and bright to the very bottom, there is no danger; but if it does not go to the bottom, there is always a possibility that carbonic acid, which is half as heavy again as air, may lie there, as in the celebrated Grotto del Cane, in which a man can stand, while a dog is asphyxiated. It is commonly supposed that carbonic acid accumulates only in old or disused wells. This is a dangerous delusion. We were present a few years ago at an inspection of a new well on the estate of our lamented editor, the late Dr. Wakely. The well had only been sunk a few weeks before in a country place remote from houses. It was loosely covered, and one of the men was about to descend for the purpose of inspection, when Dr. Wakely, with characteristic caution, insisted that a candle should be lowered first. It went out before it had gone 6 feet; and it is certain that if the man had gone down, as he proposed, he would have fallen lifeless to the bottom. The generation of carbonic acid below the surface of the earth is apparently capricious. The curious pits or caves, some of them more than 100 feet in depth, which abound in the neighborhood of Bexley, in Kent, contain no carbonic acid, as we can testify from personal experience, although they are said to have been excavated in prehistoric times; whereas, as in the instance already quoted, the gas may accumulate in a perfectly new chamber. The mere extinction of a flame is not a sufficient indication of danger. If the candle burns dimly there is risk, for the gas acts on living beings as on candles, and insensibility, or exhaustion tantamount to it, may be produced by a quantity of carbonic acid which would not immediately kill. — *Lancet.*

Sugar in Cement. — A letter in the *Times* of Wednesday, November 24, written by Mr. Thomas Hankey, points out that cane sugar and lime form a definite chemical compound, which has very strong binding qualities, and forms a cement of exceptional strength. Equal quantities of finely-powdered lime of a common kind, and of good brown sugar, mixed with water, form a mortar which has been found to join stones and even glass with great success. It is important that the lime should be thoroughly air-slaked, for if any dry particles be left they will swell and eventually break the joint. It is stated that this mortar is equal in strength to Portland cement, and that the latter may probably be improved by the addition of sugar, or, perhaps, even of treacle. A number of small experiments which have been made have proved entirely successful, and it now remains to see whether the material offers advantages in actual work sufficient to pay for its extra cost. If this should prove a new use for sugar the news would be received with welcome in our West Indian colonies, which have long suffered from the low prices brought about by the competition of beet-root. — *Engineering.*

In the next issue *Engineering* says: The letter respecting the use of sugar in cement and mortar, which appeared in the *Times* last week, and which was noticed by us, has given rise to some further correspondence. Surgeon-general W. Robert Cornish has written to say that the Indian practice of mixing "jaggery," or unrefined sugar, with mortar in certain proportions, is very ancient. In the latter part of the last century a wall was erected as a fortification to the settlement of Madras, and remained until it was ordered to be removed in 1859. The task proved exceedingly difficult, and the separation of the bricks from the mortar was impracticable. Afterwards the original specification for the wall came to light, and it was found that it required that the mortar should include a certain proportion of "jaggery" mixed with shell-lime and river sand. A copy of the document was published in the *Madras Mail* in 1873. The same writer states that the polished *chunam* walls, for which Madras is famous, are prepared with cement made with unrefined sugar. Another correspondent, Mr. Nathaniel Stevenson, testifies to the beneficial effect of adding an ounce of sugar to each half-pint of water in mixing plaster-of-Paris for models. A third writer mentions the use of "goor," a coarse sugar, as an ingredient of mortar in India. Masonry cemented with this material requires to be blasted before it can be destroyed.

TRADE SURVEYS

All of the larger lumber-manufacturing interests have made unusual preparations for a very heavy production during the coming season. Buyers will not be sorry to see the lumber manufacturers make the very tempting mistakes of overcrowding the markets. To all appearances this is likely to be done even in the face of a very heavy demand which is likely to set in early in the season. In the Northwest, in the two Virginias, and in Georgia, much sawing and logging capacity has been erected during the past few months, and those who are in the best positions to know predict a very heavy supply of white and yellow pine, hemlock, spruce, and poplar, and even walnut, cherry and oak. Some of the older heads in the trade regret that the indications point to such a heavy supply of lumber. The spirit of the trade is to rush in and take the consequences. The cornering of the lumber market is and will remain an impossibility. It would be possible to advance prices to a remunerative point and hold them there, but there is no national organization among the lumber interests, and even were it desirable, it is practically impossible. Georgia is fighting Michigan and Maine, and Pennsylvania is endeavoring to maintain its hold upon the market against many odds. In a word, the available supply of lumber is too far beyond the reach of organization. It is possible that the hard woods can be advanced permanently, but even here the chances are the other way. A great deal of machinery has been put up within easy reach of the hard-wood regions, and close attention will hereafter be given to the manufacture of hard wood because of the very general use that is being made of it in the finer class of dwellings. The highest lumber authorities say that there is nothing in the way of keeping margins as narrow in hard woods as in other kinds. The season is at a close. The stocks for the winter are only moderately large. A large amount of lumber will be moved this winter by rail both East and West. A good many new mills will be put up this winter. All of the wood-working establishments furnish good reports as to the present and prospective condition of that rapidly-growing industry. The fact is that at no time has there been a more urgent demand for wood-working and saw-mill machinery and never, in any single year, has as much old machinery been removed and supplanted with new. The lumber question is an important one at this time, and it is pleasing to note that there is very little difference of opinion among the largest manufacturers and dealers in regard to trade prospects. They seem to unite in the verdict of low prices and heavy supplies. Therefore the anticipation of future wants will be entered upon very carefully.

The lists of building permits in New York, St. Louis, Minneapolis, St. Paul, and in some cities of lesser proportions, show that although the building season is over, a great deal of work is contemplated during the winter months. Chicago's October permits were 274 for 293 buildings, and for November 176 permits for 263 buildings. St. Louis permits for November are given at 154, involving the expenditure of about $800,000. Important building enterprises are under consideration along several of the railroads leading north and northwest from Chicago. The builders in Cincinnati and Louisville entertained decided opinions as to the favorable character of next year's building operations. The industrial improvements in progress in Southern States, and which has not been exaggerated, seems to be reflected in an industrial improvement in the larger cities of the Ohio Valley. A great deal of small house building will be done in a multitude of large and small manufacturing cities. More money will be expended by employers of labor in this direction than heretofore. The labor agitations of the past year have directed the attention of employers to the advisability of centering the interests of their working people in their own homes, and quite a number of manufacturing corporations and firms have resolved upon investments in house-building intended to directly benefit their workers, and to indirectly benefit them.

The favorable reports which have been made from month to month in this survey concerning the iron and steel interests, can only be repeated. There are some indications that the iron trade is threatened with a boom. For instance, it is given out officially that 800,000 tons of rails have been sold for next year. This is fully one-half of the productive capacity. Two new mills are under way, and there is talk that three or four more may be undertaken. The industries of the country have been acting very conservatively, but the inducements of heavy business, and strong margins will overcome the conservative manufacturing interests and will lead them eventually into a race for trade which will, no doubt, end as all other periods of great activity have ended. These recurring ups and downs will continue until the problem of a just distribution of the products of labor is solved.

The steel makers are greatly encouraged by the heavy demand for their product. Several of the larger manufacturers have been consulted in a general way for steel for next year's requirements to go into coastwise tonnage, lake crafts, into engineering work, railway supplies, and in a variety of directions. The consumption of steel next year will be at least one-half greater than this, provided that nothing unusual happens to side track some of the huge enterprises that are looming up.

Within a few days negotiations have been opened for large building tracts not far from New York, Philadelphia, Chicago, and two or three other smaller Western cities. Suburban property is improving more rapidly than any other. The strong tendency to a concentration of population is helping in this improvement. At the same time it cannot be overlooked that there is an outflow of small manufacturing enterprise to which taxation and the dearer labor of cities are obstacles. At the same time real estate is improving in value both for manufacturing and residence purpose. Nothing like a speculative feature is likely to develop,

The strong features at this date are the heavy railway traffic and the probabilities of a steady increase, the doubling of our railroad mileage this year over last, and the probability of a fifty per cent increase next year. The evidences of a general increase in production and consumption, the practical unanimity of the public upon all questions of political economy, not even excepting the traffic issue, the growth of industrial enterprise in the South, the expanding opportunities for investment of capital both North and South, and finally, the more favorable prospects of friendly relations between labor and capital. A half-dozen labor conventions of one kind or another will be held during the coming winter. A very important convention has been in session this week at Columbus, Ohio. Another will be held in Cincinnati in February, another in Washington, and one is projected in New York city. There is a general spirit of organization amongst the working classes, but their coming together means nothing of which capital need be afraid.



HOUSE OF ELBRIDGE TORREY, ESQ., DORCHESTER, MASS.

CABOT & CHANDLER, ARCHITECTS.

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CONTENTS

MR. A. F. D'OENCH, the Superintendent of Buildings for the City of New York, very kindly corrects our statement that notwithstanding the law restricting the height of dwelling houses to eighty feet, such structures were now built there of greater height, and informs us that since the passage of the law no permits have been issued from the Bureau of Inspection of Buildings for any structures exceeding the legal limit of height. We will not attempt to excuse ourselves for making the statement, which was based on the statement made by one of the daily papers, usually well-informed, but we are, of course, glad to be corrected.

A FEW days ago, just after a heavy fall of snow, the roof of the Highland Skating-Rink, in Boston, fell in. It is said that a large party, of four hundred or more, would have occupied the building in the evening, but it fortunately collapsed before their arrival, and no one was seriously injured. Singularly enough, the roof was quite similar in form to that of the market-house at Lancaster, Pennsylvania, which gave way on Christmas eve some two years ago, from the weight of snow on it, but the Boston roof seems to have been rather simpler, and not so good, if any structure can be called good which is unable to support a December snow-fall. In both examples the trusses formed circular arcs, tied with iron rods, but in the Lancaster roof, if we recollect rightly, the tie-rod held the feet of the rafter, and supported struts of some kind, while the Boston roofs consisted only of a laminated rib of plank, tied at a point some distance above the springing by a rod which was simply kept from sagging by a light rod suspended from the top of the truss, and there seems to have been no strutting or wind-bracing of any kind. As shown by the appearance of the ruins, the effect of the snow-load was to distort the rib, flattening it on one side of the centre, and bulging it out on the other. This distortion brought at once a severe tensile strain on the tie-rods and cross-strains on the rafters, and it is probable, judging from the ruins, that in some trusses the tie-rods failed first, and in others the rafters, while some of the trusses, which contrived to spread in spite of their tie-rods, slipped at one end off the walls, and collapsed with the rest. The loss to the owner of the building is said to be fifty thousand dollars, on which there is of course no insurance. For the honor of the profession, we are glad to say that no architect's name is mentioned as having been concerned in the design of the truss, and the owner seems likely to have to bear alone the credit of furnishing another example of the danger of constructing buildings without regard to the ordinary rules of stability and strength.

THE attempt of the New York Board of Aldermen to injure the New York Steam Company, by compelling it to reduce the pressure in its mains to fifty pounds, has been interfered with by the veto of the Mayor, who, in his message on the subject, expresses doubts as to the dangers from malaria excited by the pipes, which some of the gentlemen of the Board thought so serious, and points out, what was evident before, that the enforcement of the resolution "would seriously affect the capacity of the company in supplying customers." The large majority in favor of the measure at its first consideration seems to show that the Board could pass it over the Mayor's veto if it were so inclined, but it is probable that it will hardly venture to do so. In fact, as the demands of politics have already been satisfied by showing the unemployed engineers and firemen and their friends how devoted the Aldermen are to their interests, it would obviously be prudent now to exhibit, for the benefit of those voters who depend in some way on the New York Steam Company, a praiseworthy care in listening with attention to the Mayor's arguments in their behalf.

WE have from time to time in the French newspapers details of the work for the Paris Exhibition of 1889, which are quite interesting. According to the plan now decided upon, the main part of the exhibition will be contained in three separate buildings, occupying three sides of the rectangular Champ de Mars, while the fourth side, toward the river, will be open except for the thousand-foot Eiffel tower, which is to stand in the middle. The two buildings on the longer sides of the parallelogram are to be devoted to the general purposes of the exhibition, while the building on the third side, which will stand directly in front of the Ecole Militaire, is to be reserved for machinery. This structure, according to the plan, measures twelve hundred and fifty feet in length, by about three hundred and seventy-five in breadth, and it is intended to cover it with a roof in a single span, one hundred and forty-five feet high, which will be, we think, the largest single-span roof yet built, although smaller roofs have been constructed of greater span, as, for instance, the roof of the rotunda at the Vienna Exhibition. As to the Eiffel tower, there seems to be now some doubt whether the residents of the neighborhood will permit the construction of an object, which, to say the least, will not add to their comfort, except as a curiosity of construction. Neither engineers nor architects seem to have taken great satisfaction in the prospect of seeing this huge structure overlooking the city, and the adoption of the scheme is said to have been due to the zeal of some of the members of the municipal government. Now, however, a considerable number of the rich and influential people who have houses near by have entered a formal protest against the erection of any permanent structure of the kind, and it would not be surprising, or particularly to be regretted, if the Commission should, even at this late day, give up the plan, and arrange to have the visitors to the exhibition take their bird's-eye view of the city from a captive balloon, or some other inexpensive and temporary affair.

A CURIOUS piece of engineering has just been carried out in Stockholm. The old city, which was built on an island at the outlet of Lake Melar, has long been given up to official residences, and to the kinds of business which officialism collects about itself, and the well-to-do citizens have removed their habitations to the suburban districts on the shores of the lake. The district on the north shore, under the name of Norrmalm, was first settled, and has become the business quarter of the town, while the southern shore, which is very steep and broken, has only within a few years, through the filling up of the other suburbs, been invaded by a rapidly-increasing population, which has built up there the town of Södermalm. So long as Södermalm consisted simply of a row of houses on the lake shore, there was no difficulty in providing quick and easy communication between it and the other portions of the city by means of ferry-boats, but people with a taste for fresh air and an extensive prospect soon took possession of the plateau of Mosebacka, a hundred feet above the water-front, and reached from it by a very steep slope, the inclination averaging one in five. If any one will try walking

up a hill of this pitch, and a hundred feet high, he will find that the inhabitants of the Mosebacka plateau needed pretty muscular legs, and, although zigzag roads of practicable grade were soon made, they were long and tiresome, and as the population increased it became more and more necessary to provide better and easier communication between the high land and the lake shore. For such purposes it is very common in foreign cities to use rope railways, but the Swedish engineers seem to have more confidence in the nerves of the public than those of France or Switzerland, and the first solution of the problem which occurred to them was to place elevators by the shore, extending nearly or quite to the height of the plateau, and connected with it by long horizontal bridges. If all these could be kept enclosed, there might be nothing particularly disagreeable about the transit; but in practice the elevator runs its course of nearly a hundred feet in an open framework, at the top of which its passengers are launched upon a long, open trestle-work, over which they must find their way to their houses on the heights. One would think that in stormy weather this light construction, secured to the ground only at one end and at the foot, would vibrate rather frightfully, even if the passengers were not blown entirely off it, but so far no accidents have happened.

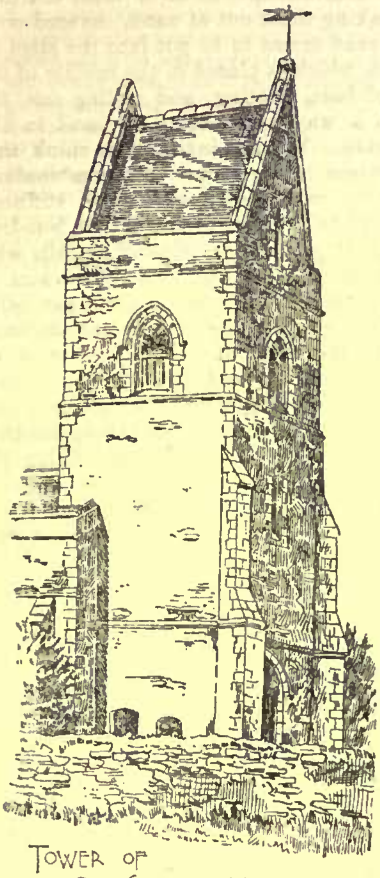
PERHAPS the public proved not quite so bold as the engineers expected, for in the second elevator, which has just been completed, the hoistway is enclosed in a large building, which contains also a *café*, reading-room, and several other apartments for the entertainment of those who wish to rest on their way home. In both cases the elevators themselves are do ble, with cars of wood, each carried by two wire ropes, and furnished with what we consider an old-fashioned safety-catch for passenger-elevators, consisting of ratchets, thrown out by a spring attached to the rope and engaging in teeth secured to the guides, after the method still used here for freight elevators. The cars are about six and one-half feet by seven, and are considered large enough to carry twelve persons, but the rule is to take only nine at a time. The machinery of the first elevators came from the United States, but that of the second pair was made in Sweden. The principle is simply that of an ordinary hydraulic elevator, fed from a closed tank beside it, into which air is forced, in the way very common among us, so as to keep the water under a pressure of about sixty pounds to the square inch. According to *Le Génie Civil*, the first set of elevators, which has been in service something more than a year, has proved very successful, transporting in twelve months nearly two million persons, and earning a large return on the capital invested.

WITH the present year the editorial management of *Building* passes out of the hands of Mr. William Paul Gerhard, whose professional engagements no longer permit him to devote the necessary time to editorial labors, into those of Mr. William T. Comstock, the publisher, who conducted it so successfully until Mr. Gerhard undertook the work at the beginning of this year. While we hope and believe that under Mr. Comstock's efficient management *Building* will lose nothing of its excellent qualities, we must express our regret at losing Mr. Gerhard from the field of professional journalism. We were sure, when he was put in charge of it, that the technical character and tone of the paper would be of the best, but we were hardly prepared to find him so familiar with the ways and thoughts of architects as his editorial work showed him to be, and the readers of *Building* will always feel, while they rejoice in their friend's growing fame as a sanitary engineer, that they may depend upon his appreciation of their feeling, and his sympathy with a profession to which he has been of no small service.

ACCORDING to the daily papers, no industry is more prolific in brilliant inventions than that of iron manufacture, and hardly a week passes without the announcement of some startling innovation in that art, which, after securing a column's notice in half a dozen journals, falls into oblivion, to be succeeded by another, equally astonishing and equally short-lived. The last of the devices to which our admiring attention has been directed is known as the "sand-core" process, and so far as we can gather from the Boston *Herald*, which is not remarkable for the accuracy of its scientific descriptions, consists in "improving" the manufacture of steel rails, shafting and other products, by making them out of sand, covered with a coating of metal. The sand seems to be got into the steel or iron by putting it in a can, which is placed in the middle of the usual bundle or fagot of bars, heating, and rolling out the whole together, in such a way as to keep the sand in the middle and the iron outside. We are inclined to think that most people will be surprised to hear that this combination, particularly when used for rails, possesses "great stiffness, making a seventy-pound rail fully equal to one of one hundred pounds made solid." This singular effect of stuffing rails with sand is even surpassed by the benefits which the same sort of filling confers upon "line" shafting, in which forty per cent, or, as we suppose is meant, two-fifths the bulk of the shafting, can be made of sand, with the effect of adding greatly to the stiffness and strength of the shafting, and, it is needless to say, of cheapening it materially. We commend this statement particularly to scientific mechanical engineers. If taking out two-fifths of the substance of a piece of shafting, and filling the hole with sand, adds materially to its strength, it would seem as if it would gain still more by replacing a larger portion of the metal with "silica," so that a length of stove-pipe filled with gravel would be just the thing for the principal shaft of a large machine-shop. Worse than this, we are told that these metallic sausages answer admirably for car-axles, so that, while we can trust engineers to draw their own conclusions as to the new kind of shafting, there seems to be no security that some railway manager may not equip his passenger-cars with such cheap imitations of good, sound iron, to the great danger of the public.

WE are far from making as much use of permanent pavements as other nations, but the fashion of solid and durable building is spreading among us, and some of our readers may be glad hereafter to remember a clever device, which, according to *La Semaine des Constructeurs*, has been recently introduced for forming handsome and desirable waterproof floors at a small expense. The usual way of making such a floor with us is to lay iron beams, with brick or terra-cotta arches between, and put a thick bed of concrete over the arches, laying the tiles on the concrete whenever it is dry. This makes a heavy and costly floor; and water falling on the tiles may in time work its way down into the concrete and masonry beneath, causing dampness and stains. The new system, invented by M. Gresly, does away with all the brickwork, terra-cotta and concrete, employing only large tiles of earthenware or artificial stone, of proper surface on top for walking on, and modelled underneath so as to form a rich ceiling, which are laid on light iron beams of V-section, such as are known in Europe as Zorès beams. The open side of the beams is laid uppermost, so that the hollow forms a gutter, exactly like the gutter of a stable, by which any water that may come through the joints of the tiles over them is conducted to a safe outfall. The cross joints of the tiles, which have no V-beam under them, are efficiently protected from leakage by being formed with a section like that of the frame of some casement windows, so that one edge of each tile hooks over into a groove formed on the edge of the next, and water that may come through runs along the groove until it reaches the ends, where it drops into the V-iron, and is carried away. Nothing could be simpler than the whole affair. The inventor claims, and apparently with reason, that if a quantity of water amounting to three feet in depth per hour should fall on the pavement, it would be immediately carried off, without the possibility of any drip into the room below; and as there is no bedding of the tiles to be done, and even the joints need not be cemented, the laying, both of the V-beams and of the floor, is very cheap. According to our experience, tiles of this kind would be better in artificial stone than in vitrified clay. As there is no danger of shrinking or warping in artificial stone, they could be made in that material of more perfect shape, and closer fit, than would be practicable with clay; while clay, even without the difficulties attendant upon its irregular contraction, could not easily be made into pieces of the size and weight desirable for giving the most solid floor, with the greatest economy of iron. Where it is desirable to admit light through the pavement, M. Gresly uses tiles of cast glass, and even for flat roofs the same construction might be used, with the addition of a covering of felt and asphalt, if necessary.

EGYPTIAN ARCHITECTURAL POTTERY.



TOWER OF OLD CHURCH, MAIDFORD.
AFTER SKETCH BY THOS GARRATT. ENG.

"WESTWARD the course of empire wends its way," and in order to trace the history of art, we must commence at the west and backward follow its course to the east, and thence to the north-eastern extremity of Africa, where we find in those lone monuments of other days in the "Black Land" the earliest and most marvellous examples of man's constructive ability resting upon a portion of the ancient delta of the Nile. Any statement, however, must stand upon a hypothetical basis which seeks to fix this point as the initiative one from which emanated that impulse which resulted in the greatest mechanical constructiveness ever known in the history of the human family. Our knowledge of Chaldea is yet very imperfect, and it is possible that as that country becomes more thoroughly explored, architectural remains may be discovered of an earlier date than those now known to exist upon the banks of the Nile. The buildings of Mesopotamia were not so well constructed as were those of Egypt, where for a long period the royal tomb was the chief object of the king's reign, and it is possible that it is owing to the indestructible manner in which the Egyptian monuments were erected that Egypt retains the palm of historical priority. The adobes or sun-dried bricks employed for constructive purposes in Mesopotamia did not possess the capacity to impart permanency to architectural works of any character, nor to offer great resistance to their obliteration through the ever-changing courses of the Euphrates and Tigris.

The ancient history of the art of pottery manufacture therefore forms a subject of great intent; for even from pre-historic periods of human existence known to us only by the tangible memorials of primitive inhabitants, this art appears to have been practised. In primitive times those who followed the plastic art produced only rude adobes, and afterward vessels of coarse clay, which were sun-dried or imperfectly baked, and which latter at a later period were occasionally ornamented with concentric and transverse scratches; from this lowly origin the potter's craft, after centuries of gradual development, finally culminated in the building of the massive pyramids, and after another lapse in those exquisite fictile forms and decorations of the Greeks, and then ebbing and flowing with the tide of European civilization, until as products of the art we find the almost unequalled ceramic achievements of to-day. The art of pottery was well developed in Egypt long prior to the time when Central Asia first offered material proof of civilization. If we reckon the pyramids of Abousere and Dashour as of the third dynasty, which, according to Lepsius, extended from 3338 to 3124 B. C., it will be readily seen that many centuries elapsed before the palaces of Nimroud were erected, and even Babylon cannot claim an age more remote. The primitive art of making adobe bricks was easily learned, and some of the earliest sun-dried bricks produced were doubtless used in the building of the various brick pyramids.

In Egypt the station of every man for life was fixed by caste; the individual could not make his own way and fortune in the world, but must follow the accident of birth, and if his father was a potter, he must be one also. The caste system was the chief agent in the decline of Egypt; it was a bar to progress, and discouraged all attempts at improvement; it crushed out personal ambition, the result being dull uniformity. Thus it happened that these people were satisfied to plod out their aimless lives completing those works which their ancestors had commenced, making not the least effort for the development of individual ideas; generation upon generation followed each other for a period of a thousand years and then failed to bequeath to posterity any indication of increased personal ability. It is thought that the business of brick-making was a royal monopoly in Egypt, as a very large number of bricks are found in that country impressed with the cartouche of its princes. Were it not for these ovals bearing the hieroglyphic characters used for the name of Egyptian rulers, it would be almost an impossibility to even approximately separate the dynasties.

The mud of the Nile is the only material in Egypt suitable for brick-making. The modern plan is the same as the old; a bed is made, into which are thrown large quantities of cut-straw, mud and water, and this is tramped into pugs, removed in lumps, and shaped in moulds or by the hand. The moulded clay is then sun-dried, not burned, the bricks of Egypt, both ancient and modern, being adobes.

Egyptian bricks vary in dimensions from 1 foot 8 inches to 1 foot 3 inches long, and are in thickness from 8½ inches to 4½ inches, and weigh about 16 lbs. The largest are those of the earliest dynasties before the sixth, and they become of smaller dimensions under the eighteenth and following dynasties. At the earlier period rude marks, spirals, curves or devices, made by pressing the finger or fingers of the hand into the moist clay, were impressed on the bricks; but from the time of the eighteenth until the twenty-second dynasty (1600 to 900 B. C.) stamps were introduced of an oval or square shape, having in relief the prænomen or name of the monarch, or the names and titles of the persons for whose buildings or constructions they were made. In the Egyptian room of the British Museum, among the Egyptian antiquities, there are bricks from the pyramids of Howara, Dashour and Illahoon, and others with the prænomens of Thothmes III and IV, B. C. 1600; Amenophis III, about 1500 B. C.; and Rameses II, about 1332 B. C. Rameses II is the Sesostris of the Greeks and the "Pharaoh the Oppressor" of the Israelites; he was the grandson of Rameses I, whose son was Seti I, and whose great-grandson Menephtah is the Pharaoh of the Exodus. The narratives of the classical writers have immortalized the military glory of Sesostris, but his achievements, as well as those of his father, Seti I, as patrons of architecture, are less well known.

At Thebes their creations were stupendous, and an inscription in the temple at Karnak states that Seti I had planned a canal to connect the Nile with the Red Sea, and at the same time to irrigate the plains of Southern Goshen. Bricks stamped with the name of the Pharaohs of the Exodus have been found at Tanis, the Ramases of the Bible, and at Pithom, where the Scriptures tell us that "the Egyptians made the children of Israel to serve with rigor, and they made their lives bitter with hard bondage, in mortar and in brick and in all manner of service in the field." (Exodus, i: 13, 14.) In Exodus, v: 7, we find that the task-masters and their officers were commanded, "Ye shall no more give the people straw to make brick, as heretofore; let them go and gather straw for themselves."

Recent excavations have been made on the site of the Pithom, the treasure-city built by King Rameses II, with the bondage labor of the children of Israel. The buildings proved to have consisted almost entirely of tremendous storehouses, built of adobes; some of these sun-dried bricks were made with straw for binding, and some without it.

We have seen in the Berlin Museum an adobe brick mixed with straw, brought from Goshen. It bears the stamp of Rameses II, who frequently made his headquarters at Tanis, from whence he started on his warlike expeditions, and there he signed a treaty which terminated one of his greatest wars, which was with the princes of the Keeta. Rameses II was continually at war with the Semitic nations, and he consequently severely oppressed the kindred race, who were subject to him, and strove to burden them with hard labor. Paintings in the tombs at Thebes depict the laborers engaged at their tasks of making bricks; but the people there represented carrying water in large pots to temper the clay, digging up the earth, kneading the clay, carrying the clay to the moulder who dashes it into wooden boxes, all under the supervision of the taskmasters who, with stick in hand, watch them, are not the Hebrews but Asiatics of some other race whom Thothmes III had brought captive into Egypt at an earlier date, and there compelled, as the inscription informs us, "to make brick for the new buildings of the provision houses or granaries of the City of Amon." The Holy Scriptures early familiarize us with the Pharaohs, the Nile, and the beautiful narratives of the adventures of the infant Moses and of the virtuous and prudent Joseph; but they make no mention of the pyramids of the land of the Nile, nor do the Scriptures mention the other monuments of human labor which abound in Egypt, and which, seemingly built to last for eternity, appear to be exempt from the common law of the obliteration of all things earthly. But these prodigious results of human constructiveness, which the Greeks called "the wonders of the world," have nevertheless been known to all of us from our earliest days.

The next step in the development of the potter's art in Egypt, after the production of adobe bricks, was the manufacture of the coarse, dull earthenware probably made from the same kind of clay of which the adobes were moulded. Vases of different kinds of pottery were used by the Egyptians for domestic and other purposes. Earthenware vases were in use at the earliest period in Egypt, and some in the collections of Egyptian antiquities come from tombs in the neighborhood of the great pyramid erected under the fourth dynasty. The Egyptian vases are distinguished by their shape, which is not so elegant and refined as the Greek, and for the thickness of the substance of which they are made. They were either unglazed, polished or painted, and when painted, the colors were laid on in tempera. Some vases have the names of the possessors inscribed on them, and a few were imitations of those in more costly material. They were made on the potter's wheel, and were rarely stamped out from the moulds. For stoppers they appear to have had lumps of unbaked clay, tied over with linen cloth by a cord passed round the neck. Various objects were deposited in the vases, such as edibles, bread, fruits, liquids, drugs, oils, wine, water, salt and salted food, and occasionally papyri, beads, figures, and the like.

The Egyptians, if not the inventors of making glass, were great workers in that substance, and early learned the method of applying a vitreous coating to pottery, and even to stone. In the glass collection of the British Museum, there is a very remarkable amulet with the prænomen of Huantef IV, a monarch of the eleventh dynasty, placed by Lepsius between 2380 and 2223, B. C.

It is difficult to fix the date when the so-called "porcelain" came into use in Egypt; its employment was certainly as old as the eighteenth dynasty, when the beautiful blue color due to the employment of copper was introduced. During a visit to the British Museum a few months since, the writer noticed a glazed steatite vase[1] from Thebes inscribed with the titles of Thothmes I, about 1633, B. C., thus showing an acquaintance with glazes more than 3500 years ago.

The manufacture of glazed tiles in Egypt, has also an earlier origin than is generally supposed. The British Museum[2] contains tiles of this character from the site of Tel-El-Yahoudeh, or "Jew's Mound," the supposed *Vicus Judæorum*, or Oneias. In using this mound as manure for the adjacent lands, numerous fragments of glazed tiles and porcelain were discovered, many bearing the names and titles of Rameses III, 1200, B. C.

At the period of the twenty-sixth dynasty, a pale apple-green colored ware came into use, and continued till the time of the Greek and Roman rule, when jugs in the shape of the *oinochoe*, or wine-bottles, ornamented with figures in relief were fabricated, and bore incised inscriptions with the name of the reigning monarch.

The ancient Egyptians did not possess the art of painting as it is known to us to-day; the six colors which they mostly employed, red, yellow, blue, green, black and white, were applied for decorative purposes without regard to the truth of the object which they attempted to depict, and the degree to which they conventionalized all natural objects in their picture-writing made truth, sympathy, and faithfulness in delineations and colorings completely secondary to decorative laws. The glazing, enamelling, glass-works, and, in fact, all the arts of Egypt, reached their greatest development under Alexander and the Ptolemies (332 to 30 B. C.); and during the Roman Dominion they produced very elaborate specimens, especially minute mosaic patterns, of which there are good examples. These were made by arranging in the required patterns a number of slender rods of glass, of various colors, fusing them together, and then drawing them out, so as to uniformly reduce the whole; transverse sections of the rod thus obtained would each exhibit the same pattern. The manufacture of glass was probably introduced at Rome by Egyptian workmen; the material was applied to a great many uses, and the processes seem to have been quite as varied and well understood as in later times. The common glass has usually a bluish or greenish hue, although it is not infrequently as white and brilliant as rock crystal; and it was highly prized by the Romans; different shades of yellow, blue, green and purple, form the other usual transparent colors. The employment of gold is thought to be the means by which the delicate and beautiful pink color which is so much admired was imparted. It is not often that the opaque colors are employed singly, but when used they occur in shades of yellow, blue, green and black. Occasionally a colored ground was covered with white opaque glass, which was afterwards cut away, thus producing a cameo. The celebrated glass vase deposited in the British Museum by its owner, the Duke of Portland, and hence popularly known as the Portland Vase, is an instance of the last-named method of ornamentation. This vase was found in a marble sarcophagus in the Monte del Grano, near Rome, and was formerly in the Barberini Palace. The ground of this vase is of blue glass, the design is cut in a layer of opaque white glass, the composition is supposed to represent, on its obverse the meeting of Peleus and Thetis on Mount Pelion, and on the reverse Thetis, in the presence of Poseidon and Eros, consenting to be the bride of Peleus; a bust of Attys is represented on the detached bottom of the vase.

In other instances, a number of different colors were employed sometimes, as in the Egyptian specimens above noticed, forming regular mosaic designs, sometimes blended into a mass of scrolls, rosettes, etc., and at other times imitating agate, madrepore marble, onyx, porphyries and other hard stones, though generally in more brilliant colors. The mosaic glass, and especially that imitating various stones was often employed to line the walls, or to form the pavements of rooms.

The beautiful blue color which, as has been previously stated, was applied to the so-called Egyptian "porcelain," was due to the presence of a double silicate of copper and sodium, and one of the earliest uses of this glaze for architectural purposes was for the decoration of the jambs of an inner door of the Pyramid of Saqqara. These tiles were probably made expressly for the position which they occupied in the decoration of the doorway, and this statement is corroborated by the presence of numerals in hieratic characters on the backs of the tiles. These tiles are about one inch in width, and are twice as long as they are broad, and the exterior surface is slightly convex; other tiles, however, are rectangular, and in order to more easily fit into the plaster they are bevelled inward, and are almost black in color; but probably the greatest use of tiles of this character is to be found in the ruins of the Tel-El-Yahoudeh, the supposed *Vicus Judæorum*, or Oneias, to which reference has previously been made. "The walls of this edifice were revetted with porcelain tiles containing the legends and conquests of the monarch Rameses III. Some of the tiles consisted of long rectangular slips with the hieroglyphs incused and inlaid with pastes or colored glass fitted into the incused portions. The background of these tiles were generally blue. Some square tiles have a yellow background with the hieroglyphic name and titles of the monarchs inlaid in colored paste, producing a varied and lively effect. Another class of tiles representing Asiatic and negro prisoners conquered by the same king are of an entirely novel character and resemble modern Palissy ware. The figures of the prisoners are in relief on a flat rectangular ground; portions of the garments and the backgrounds are inlaid with colored pastes of various hues, the features and flesh of the limbs are appropriately glazed, and the hair or head-dress — especially of the negroes — of colored pastes. They are well-made, and are fine specimens of toreutic work in relief."

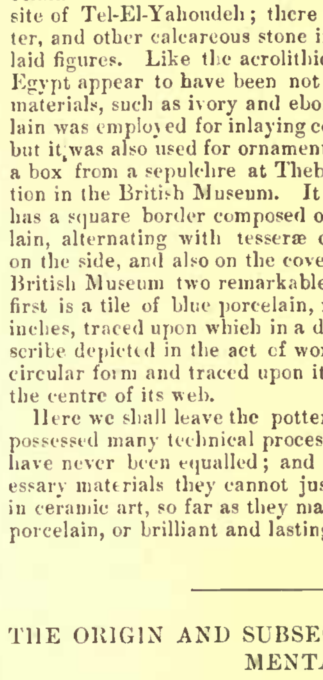
We have previously stated that numerous fragments of glazed porcelain were discovered with the tiles in moving the mound on the site of Tel-El-Yahoudeh; there were also found portions of alabaster, and other calcareous stone in the shape of heads and arms of inlaid figures. Like the acrolithic statues of Greece the early ones of Egypt appear to have been not infrequently composed of different materials, such as ivory and ebony, or wood and porcelain. Porcelain was employed for inlaying coffins and other sepulchral purposes; but it was also used for ornamenting domestic articles, as is shown by a box from a sepulchre at Thebes, and which box is now on exhibition in the British Museum. It is of a very dark-colored wood, and has a square border composed of rectangular tesseræ of blue porcelain, alternating with tesseræ of red-colored ivory; this border is on the side, and also on the cover of the box. There are also in the British Museum two remarkable objects intended for inlaying; the first is a tile of blue porcelain, measuring about six inches by four inches, traced upon which in a darker blue color is a figure of a royal scribe depicted in the act of worshipping Osiris; the second is of a circular form and traced upon it is the representation of a spider in the centre of its web.

Here we shall leave the potteries of Egypt; although this people possessed many technical processes of great value, and their textiles have never been equalled; and yet having an abundance of all necessary materials they cannot justly claim other than a low position in ceramic art, so far as they made efforts for the production of true porcelain, or brilliant and lasting enamels.

Charles T. Davis.

[1] No. 4762. Second Egyptian Room.
[2] Case D. First Egyptian Room.

THE ORIGIN AND SUBSEQUENT GROWTH OF ORNAMENTAL ART.[3]



It seems to me that ornament on wares had its origin not merely in an attempt to escape from the wearisomeness of labor, but rather in an expression of pleasure, in the hope and sense of power and usefulness which men in the making of things felt in the childhood of the world. That pleasure of labor did not fail man for many ages. That which makes Gothic art — by which term is indicated the work of the Middle Ages — what it is, is its freedom. It was above all things the art of the people — the art of coöperation. No craftsman who is a real one is despised in it. There is room for every mind and every hand that belongs to a real man; something to express, and some means of expressing it are all that is asked for. All the time this art lasts no handicraft lacks beauty for a moment, nor is any one set to dull and slavish toil. Things grow beautiful under the workmen's hands, without effort it would seem, and men do not know how to make an ugly thing. Nowadays, when we light on a piece of the household gods of this period we pay vast sums of money for it and treasure it up in a museum, for it teaches us — us who know everything else — this rough piece of handiwork, done by an artisan who thought that the world was like a flat dish, and that the sun went round the rim of it. If this seems strange to you, let me remind you of one kind of work wrought by these craftsmen which are both more accessible and more impressive than their moveable household goods. I mean some of the buildings which our forefathers lived in, and among which it is your rare good fortune to live — a good fortune which I hope will leave its impress in many an hour of sweet indestructible pleasure on the future lives of every one of you. Centuries we cannot count lie between the day when the cave-dweller scratched his drawing of a mammoth on a mammoth's bone, and the day when the English masons and wood-carvers struck the last stroke before the reformation on the work at, say, St. George's Chapel, Windsor. During all those ages, whenever we

[3] From a lecture by William Morris, delivered at Manchester on Sunday, September 26, and published in the *British Architect*.

catch a glimpse of the life of the people we find the popular arts progressive on the whole, and seldom failing in their first aim of lightening the toil of man by giving him pleasure in his daily work. A long lapse of years indeed, while from the time when Sir Thomas More wrote his eloquent attack on commercialism and land-grabbing till now, the days are few, the time short.

But what has happened to popular art in that short while? What has happened to the popular arts, I say, in those three hundred years of struggle, mostly successful, for religious and political liberty, in those centuries of miraculous progress, during which England has grown from a semi-barbarous island-kingdom into a mighty empire, the master of the minds of men as well as of their bodies? I can tell you in three words what has happened to those arts; they have disappeared. That is a strange story indeed; and you may well doubt its truth, the change is so tremendous. But my whole position is this, to have popular art, or the art of the people, it must be made by and for the people, which means, as I have said, that man's handiwork is universally beautiful to the eye and elevating to the mind. But such art as pretends to be popular nowadays, do the hands and minds of the people fashion it? Do the people use it? Are the people rejoiced with the making and the using of it? So far is this from being the case that the people do not even know that such an art exists or ever has existed. What pretence there is of decorative art is little touched by the people's hands, and not at all by their minds. They work at it not knowing what they do. Like all other toilers nowadays, their work is a grievous burden to them, which they would cast off if they could. We cannot help knowing that not another hour's work would be done on the decorative arts to-day if it were not that the workers feared death by starvation if they left their work. I hope you do not suppose that on these terms of labor you can have an art which has any life in it. If you do you are dreaming, and will have rude awakening some day.

The existing gulf between rich and poor, which is in fact a gulf between civilized and uncivilized people living in the same state and under laws nominally the same — this is the gulf which has swallowed up the popular arts; the art which raised our ancient buildings here and elsewhere, and under which every man's intelligence, were it great or small, was used and subordinated at once for the creation of a great work of art, whereas now it is accepted as a fact that whatever intelligence one of the non-gentlemen class may possess is not, and cannot be exercised during his working hours. In order to win that privilege, he must raise himself out of his own class and become a gentleman. The essence or soul of popular art is the due and worthy delight of each worker in his own handiwork — a delight which he feels he can communicate to other people, as it has been communicated to him by the thoughts of many generations of men under the name of tradition. If any of you care about art in any form, I am sure you will allow that this reciprocal pleasure of communication is always present at the birth of a work of art. When you have been listening, for instance, to a beautiful piece of music, could you possibly suppose that it was an irksome task to invent the sounds which were filling your whole soul with satisfaction, or, when you have been reading some beautiful passage of poetry, could you suppose that the strong and melodious words which were elevating your soul and opening new worlds to you had been given forth from the writer's brain in a dull and pleasureless mood? Surely it is impossible that it should be so.

Yet remember, the artist's, the musician's, the poet's work is not easy; it is real labor enough unless he is a pretender. There are traps and pitfalls on the right hand and on the left into which his hope of creating a work of art may fall, and against which even the best man has to be laboriously on his guard. I say he is a workman or no artist, and on these grounds I claim some share of the divine pleasure of creation which accompanies it for all handicraftsmen, believing firmly that the making good of this claim is a necessity for the world, if civilization is to be anything else than a name. For, first, unless this claim is allowed and acted on, unless it is insisted on as a necessary part of the organization of society, it must be the rule that all things made by man for the use of his daily life will be ugly and base, will show wherever they are placed as mere blots on the beautiful face of the world. And secondly, it will surely be but right and just that they should be ugly and base, for so done they will be but tokens of the enduring sorrow and slavery of the great mass of mankind; for all people not dishonest must work, and in one way or other their working hours must be the most important part of their lives. If, therefore, they have due hope, pleasure and honor in their daily work, their lives will, on the whole, be happy: if they lack that hope, pleasure and honor, their lives will be unhappy. It would, therefore, be unjust that art should come from the unhappy lives of the most of men, or in other words that the great mass of people should toil miserably for the pleasure of a few dishonest people. Fortunately you see, as far as the arts go, that cannot be; it is a question of art and the happiness of the worker, or lack of art and his unhappiness.

For these days, then, in which man has obtained so much domination over the forces of nature, in which so much of what passes for wealth is produced, in which society taken as a whole either is or could be so rich — in these days what are the conditions of life for the working classes — that is to say, for most men — which would produce beauty and happiness for the world?

(1) No honest or industrious man must be under fear of poverty. The sordid troubles which this fear produces destroy imagination and intelligence, or turn them into other channels than the hope of giving pleasure to the world. Every man, therefore, must be certain of earning a due livelihood, by which word I understand all things necessary for his mind as well as his body.

(2) All men must have due leisure — rest for body and mind, time for following according to their bent other occupations than the mere bread-winning one, even if it be pleasant: and if their bread-winning work is of such a rough nature as of necessity to lack art or expression of pleasure in it, the daily hours of such labor must be very short.

(3) It follows from this last remark that all work in which art or pleasure is impossible should be done without as far as may be — that it should be looked on as a nuisance to be abated, a sickness of society. As far as possible it should be done by machines, and machines should never be used for doing work in which men can take pleasure; whereas at present, as we all know too well, men do the work of machines and machines of men — both disastrously.

(4) Those who are to produce beauty must live amidst beauty; their homes and surroundings must be clean, orderly, and in a word beautiful. This should be no hard matter to accomplish, since the whole is beautiful save where man has made it ugly.

(5) All men should be educated, and have their due share in the stored-up knowledge of the world, so vastly greater now than in the days of art, but so much more unequally shared. All men, I say, should be educated, not down to their "station in life," as people call it — that is, according to the amount of money their parents may have — but according to their capacity.

(6) When all these claims are allowed and acted on, the last claim I make for labor will come of itself — that is, that there should be an end of class distinctions, that is to say, that all crafts should be honorable and honored, and that every man should be able to rise to eminence and fame by the exercise of his own craft, the work he understands best; whereas at present he can only rise to eminence by deserting his craft, by taking an undue share of the wealth of the world as wages for doing lighter work than his fellows, by becoming a capitalist, as the phrase goes.

To my mind these are the conditions of life for working men, or really for all men, under which we can have in these days once more popular art, or a happy life for most men. Is it worth while to strive to bring about this happy life? If it be, can we say that the price to be paid for it can be too high, whatever it may be? You will have understood, if you have followed my statement of the due conditions of labor, that in my belief that price is the reconstruction of society, for no mere palliatives of the evils of the present system will bring about those conditions. Furthermore, I admit that such a great change would involve the sacrifice from many of us of things now much cherished; yet, as I believe that those who uphold the present conditions of labor on the grounds of self-interest do so rather from stupidity than malice, so I think that their loss, or punishment if you will, will be rather imaginary than real when the change comes. I think what we shall chiefly have to sacrifice will be the incumbrances, the troubles, the sorrows even, which we now cherish as part of our wealth. As to the means by which the reconstruction is to be brought about, I must, for more than one reason, say nothing of them to-day save this, that you yourselves in one way or other will, as time goes on, have offered to you opportunities of helping forward or of hindering that reconstruction. I believe the time is at hand when each one of us of the well-to-do and rich classes will have to choose whether he will strive to have the great mass of men his equals and friends, or to keep them down as his slaves. When that time comes may we all remember this, that wretched and shameful as is the condition of a slave, there is one condition more wretched and shameful still — that of slaveholder.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE ROTCH TRAVELLING SCHOLARSHIP DRAWINGS. — PLATES XXXIV, XXXV, XXXVI.

[Issued only with the Imperial edition.]

COUNTRY PLACE AT MERION, PA., NEAR PHILADELPHIA, FOR GEORGE L. CRAWFORD, ESQ. MR. B. LINFOOT, ARCHITECT, PHILADELPHIA, PA.

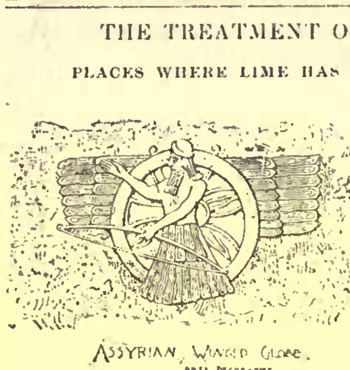
DESIGN FOR A CITY HOUSE. MR. J. N. TILTON, ARCHITECT, CHICAGO, ILL.

TOWN-HALL, TÜBINGEN, WÜRTEMBERG. SKETCHED BY MR. F. THORNTON MACAULAY.

CONVENT OF THE HOUSE OF THE GOOD SHEPHERD, TROY, N. Y. MR. T. O'GRADY, JR., ARCHITECT, BOSTON, MASS.

THE TREATMENT OF SEWAGE.[1] — VI.

PLACES WHERE LIME HAS BEEN OR IS BEING USED.



Assyrian Winged Globe.

Hertford. — Population about 7,000. Lime was employed from 1858 to 1875, at a cost of £410 per year.

Alton (*Hampshire*). — Population 4,192. (Chloride of iron also used on hot days.)

Balsall Heath (*Worcestershire*). — Population 14,000. Filtration through gravel. Effluent discharged into Birmingham and Warwick Canal.

Blackburn (*Lancashire*).—Population 83,000. Lime used as an auxiliary to irrigation.

Birkdale. — Population 8,705. Cost, £1,000 per annum (= 5d. rate). Sewage treated 650,000 gallons daily. Lime used per year, 208 tons.

Birmingham. — Adopted in 1873 on the recommendation of Mr. Hawksley. Lime is added to the sewage at a distance of one-third of a mile from tanks (13 tons to 12,000,000 gallons). The treated sewage flows into tanks, and the effluent passes into the River Tame. About 400 tons per day of precipitate obtained, which is partially dried and burned. General Scott attempted to make Birmingham sludge into a cement, but not with marked success.

Bromley (*Kent*). — Population 12,000. Filtration through gravel after lime treatment.

Burton-upon-Trent. — Population 20,378. Sewage very foul (about 6,000,000 gallons daily) on account of the brewery refuse, and often of a high temperature. Lime used up to 1883 at the rate of one ton per million gallons. Cost of treatment £2,000 to £2,500 per annum. Irrigation on 460 acres now adopted.

Bradford (*Yorkshire*). — Population 173,000. Eight to eight-and-a-half million gallons daily, containing much manufacturing refuse. The sewage is screened, 300 tons of deposit a year being thus obtained. It is then precipitated with lime (1 ton [? grain] to a gallon), and passed into tanks, where it is allowed a rest of from thirty to forty-five minutes. Effluent discharged into Branford Beck, a tributary of the River Aire. Cost 8d. per head of population. For a short time the sewage was filtered through peat charcoal, by the Peat Engineering and Sewage Filtration Company.

Chester. — Population 35,232. 1,500,000 gallons per diem. Some of the sewage treated with lime, but the most part by irrigation. Effluent discharged into River Dee.

Ealing. — Population 9,959.

Harborne (*Staffordshire*). — Population 5,105. Lime in conjunction with filtration through gravel, coke, and charcoal.

Leicester. — Sewage dealt with partially and inefficaciously.

Luton. — Sewage contains chemicals used in bleaching and dyeing straw plait.

Lime treatment has also been used at Banbury, Coventry, Cheltenham, Halifax, Hitchin, Leamington, Leytonstone, Leeds, Newcastle-under-Lyme, Ormesby, Over Darwen, Oxton, Southboro, Tottenham, West Ham and Worksop.

Lime undoubtedly has its objections, foremost of which are:

1. If the lime be added in a sufficient quantity to produce good results (which it can be) the amount of sludge produced is very large and very valueless, consisting principally of non-nitrogenous organic matter and carbonate of lime.

2. The effluent is strongly alkaline, and, therefore, more or less liable to putrefy.

3. Free lime is injurious to fish life. Hence a lime effluent is liable to destroy the fish in a river, unless it be, previous to discharge, treated with an acid.

LIME AND CHLORIDE OF LIME.

At Hertford, in 1886, about 8¼ bushels of lime and 150 lbs. of chloride of lime were used daily in the treatment of 1,640,000 gallons of sewage per day (= lime 2 grains, chloride of lime 0.64 grains per gallon). At this time the population was 7,000, showing the great quantity of subsoil water that must have mixed with the sewage in its transit to the works (= 234 gallons per head). The lime (as cream of lime) added, was apportioned to the rate of flow by little buckets attached to a water-wheel. The treated sewage was now discharged into a depositing tank. The tanks are in duplicate, each tank being worked three days, where it remained about forty minutes, a period too short for complete subsidence. The tank was divided under the water-line by a cross-wall, the sediment being thus kept back, the supernatent water being then filtered through 6 or 7 inches of coarse gravel and 3 inches of fine sand. The filter required cleansing daily. From the filter-beds it passed into an effluent channel about a mile long, to be discharged into the River Lea at Ware Mill. About 12 cwt. of sludge was removed daily. After flowing along the outfall channel for a quarter of a mile, it became clear, fish and vegetation being found in the water in abundance.

[1] A paper by Dr. C. Meymott Tidy, read before the Society of Arts, April 14, 1886, and published in the *Journal* of the Society. Continued from No. 572, page 279.

In 1866 the following analyses were obtained:

Date.	Matters in solution.			Matters in suspension.		
	Total solids.	Organic.	Mineral.	Total solids.	Organic.	Mineral.
Raw sewage, Aug. 26	26.95	1.70	22.25	2.45	1.05	1.0
Effluent, "	26.10	1.00	25.00	0.85	0.35	0.5
Raw sewage, Aug. 31	29.30	1.95	27.35	6.30	3.25	3.1
Effluent, "	27.25	1.20	26.05	1.30	0.60	0.7
Raw sewage, Dec. 13	30.33	5.35	24.98	5.39	0.71	4.68
Effluent, "	27.00	2.51	24.49	0.74	0.24	0.50

In 1867, 3.43 grains of lime and 0.33 grains of chloride of lime were used per gallon, and the analysis (November) was as follows:

	Matters in solution.				Matters in suspension.		
	Total solids.	Organic.	Ammonia.	Oxygen to oxidize.	Total.	Organic.	Mineral.
Raw sewage.	25.0	2.50	0.31	.296	1.42	0.72	0.70
Effluent.....	28.33	1.25	0.45	.281	0.43	0.17	0.26

The chloride of lime, although only one-third of a grain per gallon, not only disinfected the sewage, but prevented the growth of the sewage fungus.

My experience enables me to speak favorably of the employment of chloride of lime with lime, especially in hot weather. About 56 lbs. per 1,000,000 gallons will be found, as a rule, fully sufficient for a sewage represented by 30 gallons per head of the population.

LIME AND SULPHATE OF SODA.

Fulda's Process. — This process was tried on a small scale at Pratt's cloth mills (Yeadon, near Leeds), and at Barnsley Union Workhouse in 1873. The process was abandoned, the effluent not proving satisfactory.

SALTS OF MAGNESIUM WITH TAR AND LIME.

Fritz Hillé's Process.—The process of Fritz Hillé (patented 1870) was to be used as follows: — A mixture of lime (100 lbs.), gas-tar (3 lbs.), chemical salts, viz., chloride of magnesium (17 lbs.), were made into a paste with 180 lbs. of water. Hillé, however, does not bind himself to these exact quantities, varying them according to the composition, strength, and quality of the sewage to be treated. From the decomposition of the magnesium chloride by the lime, a bulky precipitate is formed, which carries down the suspended matter.

The exact quantity of paste to be added must also be a matter of experiment. It will vary from ¼ lbs. to 1 lb. per 100 gallons, or from 10,000 lbs. (= 4 tons, 9 cwt., 1 qr., 4 lbs.) to 2,500 lbs. (= 1 ton, 2 cwt., 1 qr., 8 lbs.) per million gallons. This quantity, however, supposes subsequent filtration.

Hillé suggests that the sludge may be advantageously used again as a precipitant for fresh sewage, employing for this purpose a mixture of from two to five parts of sludge with one part of the paste. Further, he considers that depositing tanks are not essential, but that the sewage after treatment may with advantage be applied directly to the land.

If tanks be employed, they should not be used for more than three days at a time. (See paper by Hillé, Society of Arts Conference, 1879, p. 139. See also Hillé's pamphlet on "Sewage Disinfecting, with Analyses by Letheby,") pp. 13 to 15.

The following are places where Hillé's process is or has been employed: —

Edmonton.—Still in use. Population 15,000. Daily sewage 800,000 (domestic and dilute). The materials are added in the proportion of 3 tons, 7 cwt., at a cost of £6 per 1,000,000 gallons (= 1*s.* 2*d.* per head per annum). The sludge formed is stated to be 3 tons daily. There are 114 acres of land used for subsequent irrigation with the effluent.

Tottenham.—(Population 23,000; sewage 1,200,000 gallons daily.) The cost of maintaining the works in 1875 was £1,979.

Windsor, *Aldershot*, *Leicester*, *Grantham* and *Taunton* have also used the Hillé process.

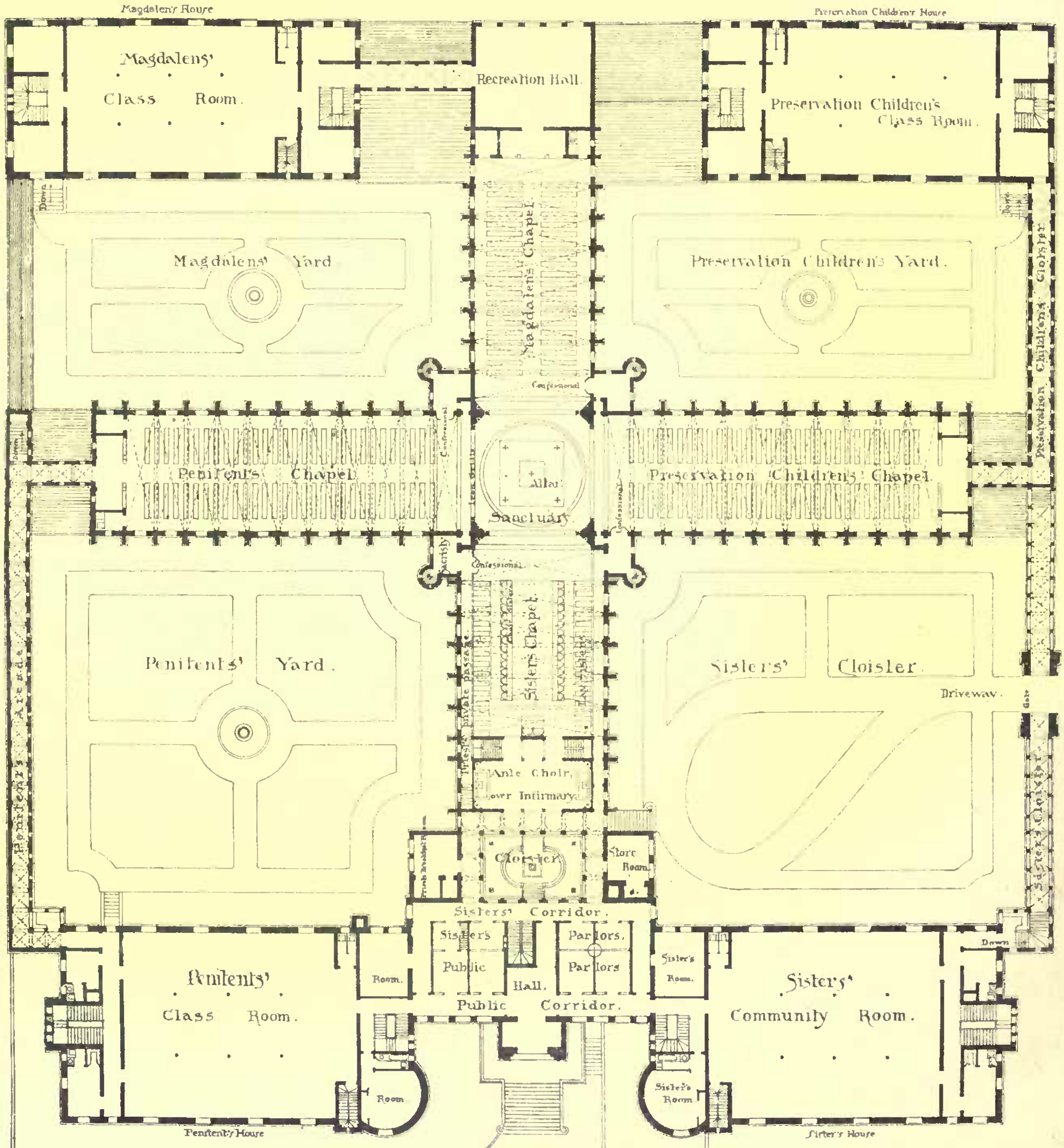
At *Wimbledon*, Surrey, (population 12,500) the process was employed from 1870 to 1876.

SALTS OF ALUMINA.

Numberless patents have been taken out for treating sewage by means of compounds of alumina.

If sulphate of alumina only be used, the ammonia of the sewage would in time effect its decomposition, resulting in the precipitation of alumina. The action of alumina thus set free is to combine with the soluble organic matter, with which it forms an insoluble compound. Thus it is used as a mordant or fixing agent for colors when applied to fabrics, and to precipitate coloring matters from their solutions, forming insoluble compounds called "lakes." Ammonia and phosphoric acids are also fixed by aluminous compounds.

Stothert (1852) patented a mixture of sulphate of alumina (or sulphate of zinc), caustic lime and charcoal (obtained from sewage or night soil) as a precipitant for sewage. The quantities suggested were 73.5 grains respectively of sulphate of alumina and charcoal, 3.5 grains of sulphate of zinc, and 22 grains of slacked lime per gallon. The lime was to be added first, and then the mixture of



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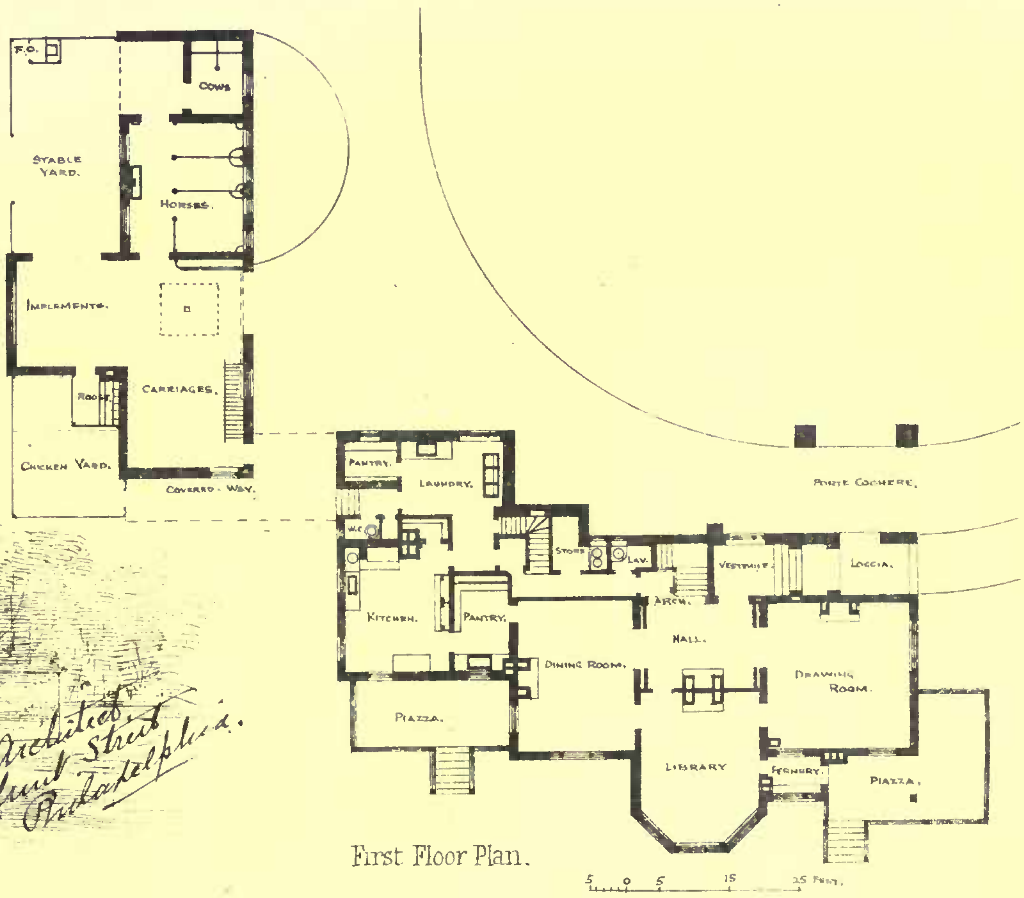
Entrance Front.

"A Country-Place,"
at Merion, near Philadelphia.

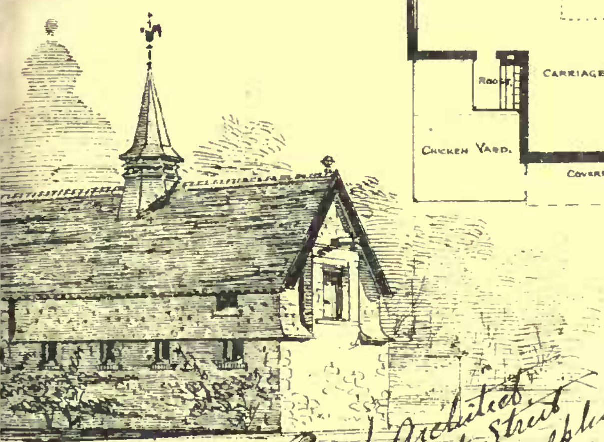
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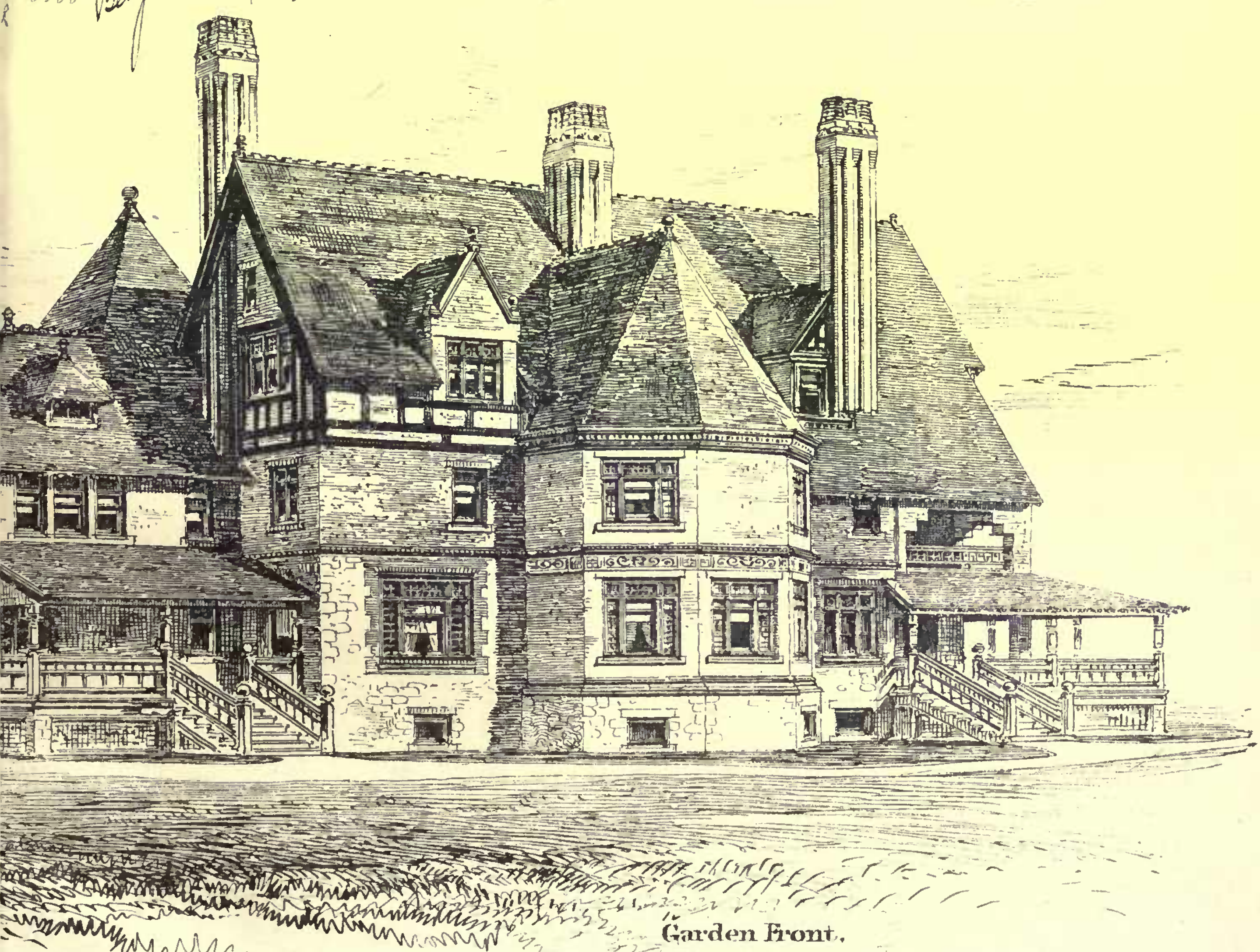


First Floor Plan.



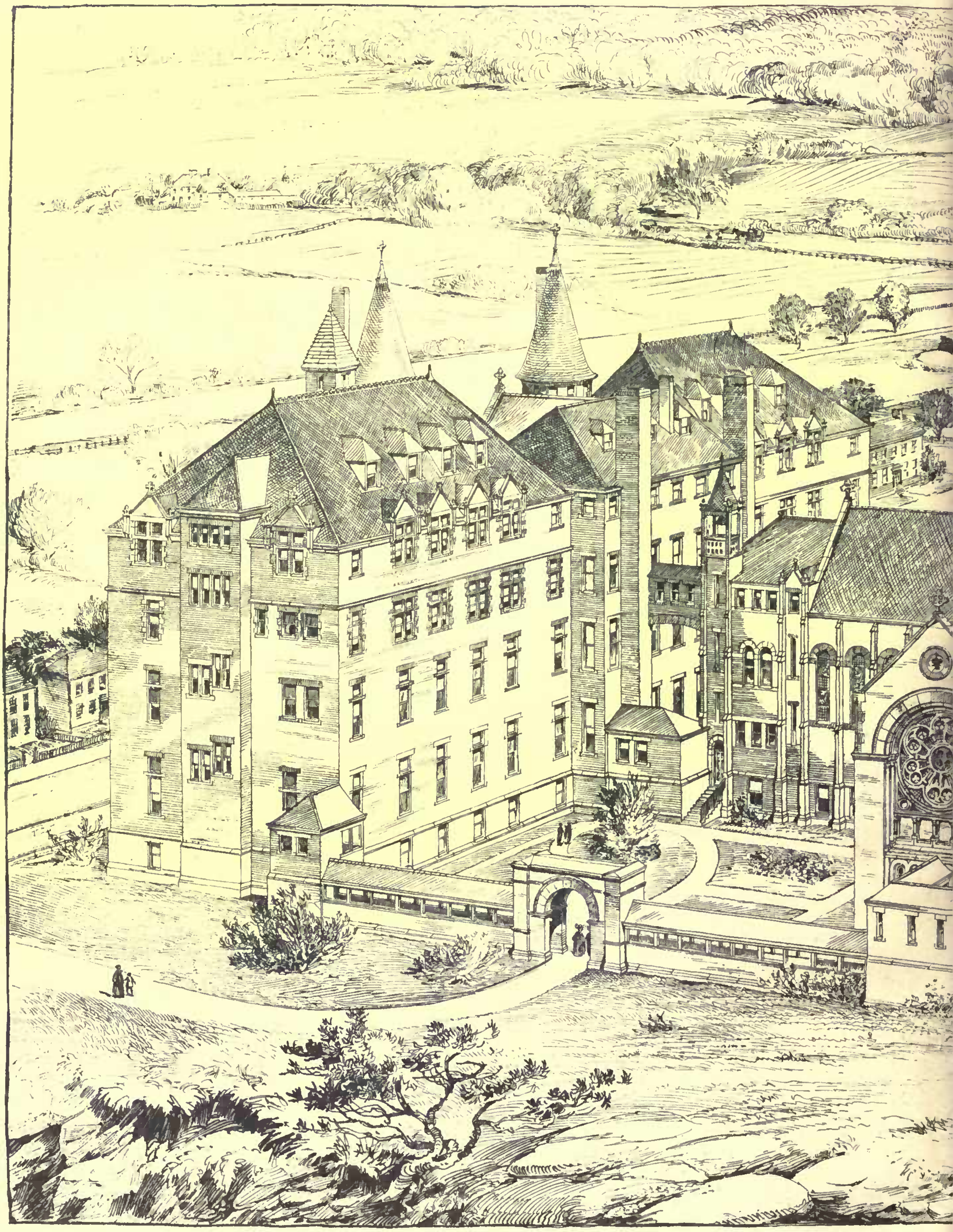
Benjamin Linfoot Architect
719 Walnut Street
Philadelphia.
1886

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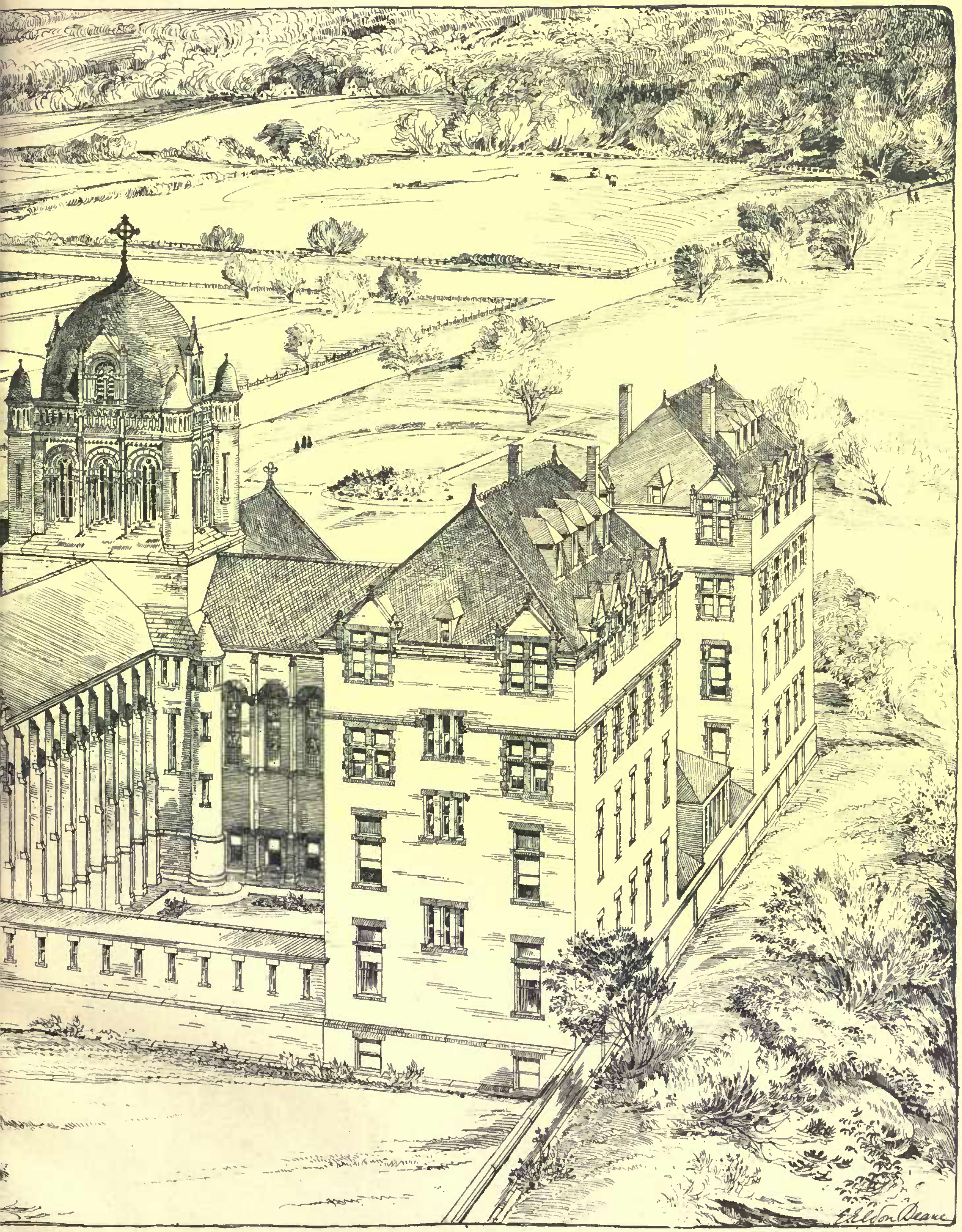
Garden Front.

American Architect a

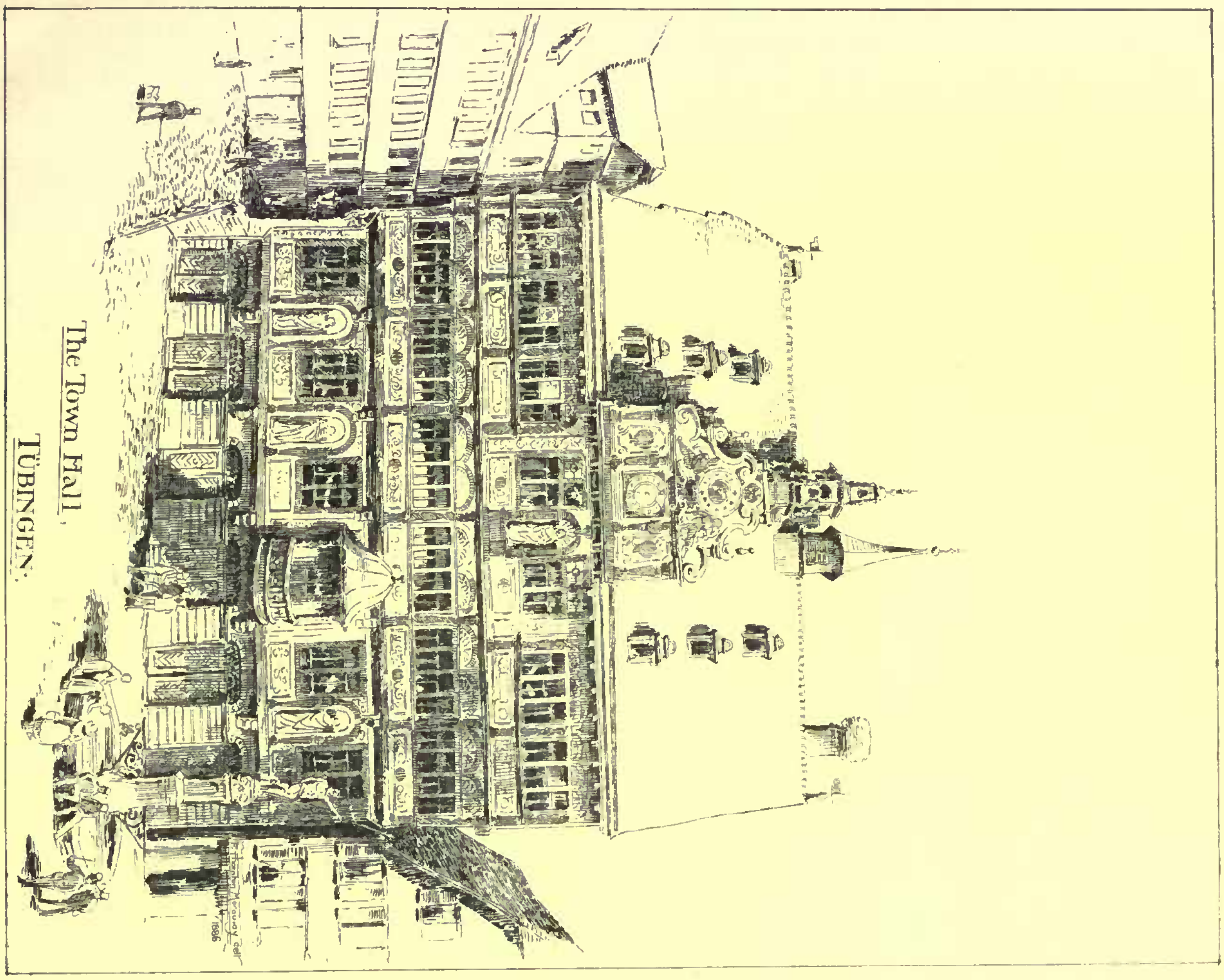


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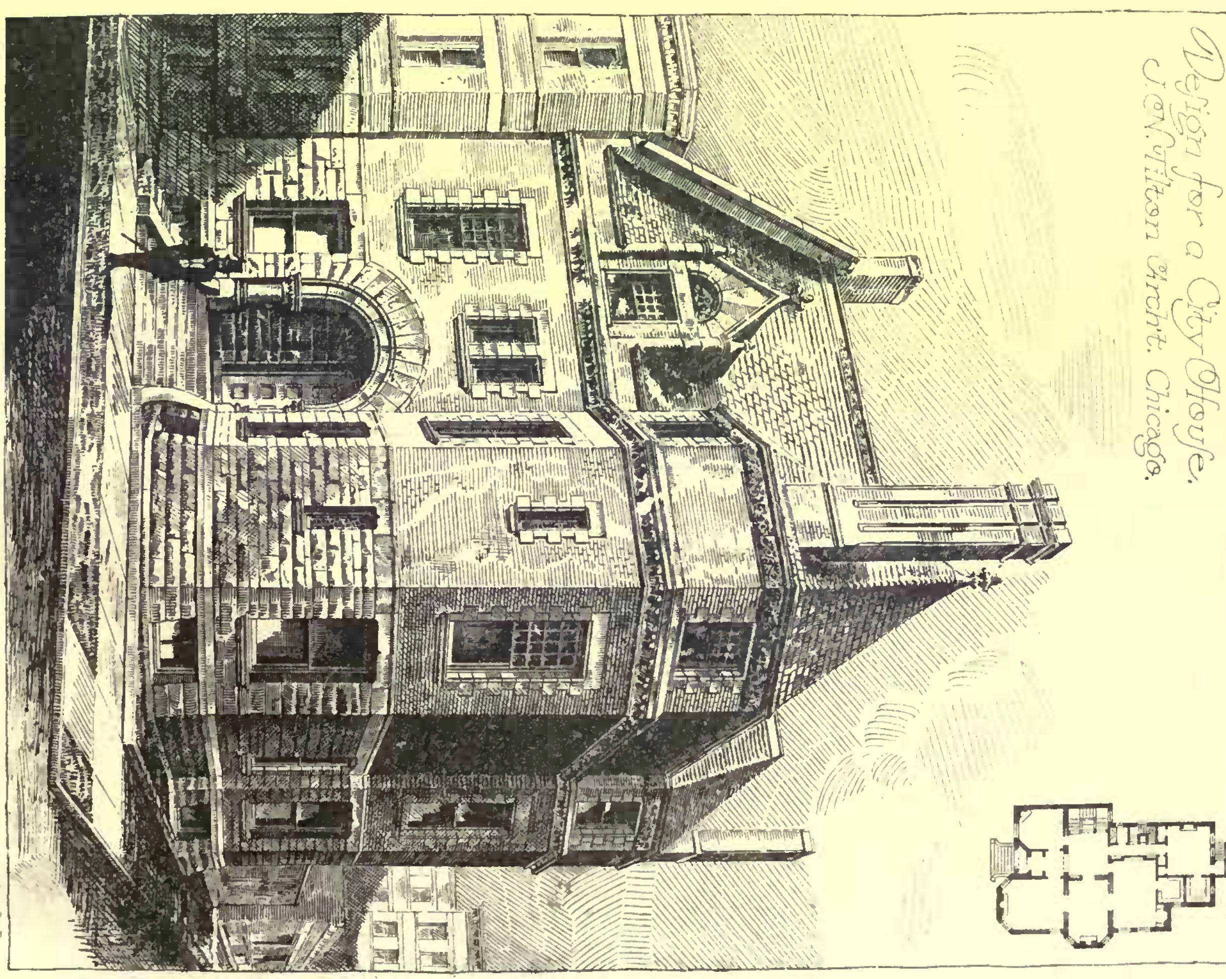
T. O Grady.



…hepherd · Peoples Avenue · Troy · N·Y·
…t. Boston. Mass.



The Town Hall, TÜBINGEN.



Design for a City House. J. M. Tilton Archt. Chicago.

charcoal with sulphate of alumina. Hoffmann and Witt report (1857) the following results produced with 5 ozs. of lime and 10 ozs. of the alumina mixture to 40 gallons of London sewage: —

	Matters in solution.			Matters in suspension.		
	Total solids.	Organic.	Mineral.	Total solids.	Organic.	Mineral.
Raw sewage.	107.6	52.36	55.24	52.49	36.4	16 09
Effluent.....	87.73	37.56	50.17	none.	—	—

They record that the addition of the alumina caused a marked increase of suspended matter, as well as a largely increased flocculation and rapidity of subsidence.

Stothert claims that a ton of the materials, costing 30*s*., will make 2 tons of manure, worth £2 2*s*. per ton, containing, when dried, 1.44 per cent of ammonia, 8.6 per cent of phosphate of lime, and 34 per cent of organic matter.

I do not know of this process having been employed on a large scale.

Lenk's deodorizing liquid (patent, 1865) was a solution of alum cake (crude sulphate of alumina), containing 12 per cent of alumina. In the case of London sewage, 25 grains by weight of the solution sufficed to defecate a gallon efficiently, a very flocculent precipitate forming, which required about thirty minutes to subside.

This process was tried in Tottenham in 1858 for about one week, one ton of solution (value £6 10*s*.) being used to treat 4,900,000 gallons (700,000 daily). The following results were obtained: —

	Matters in solution.				Matters in suspension.		
	Total solids.	Ammonia.	Organic.	Phosphoric acid.	Total solids.	Organic.	Mineral.
Raw sewage.	91.10	9.76	42.30	3.77	367.7	225.6	142.1
Effluent.....	63.39	4.23	9.70	trace.	3 01	0.77	2.24

The precipitation was very successful. Voelcker reported that "the effluent might be poured into any watercourse without causing a nuisance." He valued the dry deposit at from 25*s*. to 30*s*. per ton.

A curious history is here presented of a local authority, guardians of the public health, and moreover, under an injunction not to pollute the Lea, trying a process for one week, which they admitted gave "fair results," and which others know to have been more than fair, and then abandoning it, whether from carelessness or parsimony I do not know.

Manning (1853) suggested as a sewage precipitant, a mixture of animal charcoal, alum, carbonate of soda, and gypsum, some caustic lime in addition being also advised. The use of alum, on account of its expense, was afterwards dispensed with (patent, 1854), by the employment of a waste obtained in the course of the alum manufacture from the rough liquors (called soft sludge, consisting of sulphates of iron and alumina), and afterwards (patent, 1855) by the use of various aluminous minerals and earths (alum slate, etc.) treated much in the same way as that adopted in the preparation of alum.

The sewage was to be treated as follows: — The aluminous preparation was to be added to the sewage, and the whole agitated, the unslacked lime with animal charcoal being introduced during the mixing. The treated sewage was then to be allowed to subside in proper tanks.

This process was favorably spoken of by Penny, of Glasgow, who gives the two following analyses of the sludge: —

	Per cent.	Per cent.
Ammonia.........	2.22	0.884
Phosphate of lime.........	2.05	13.57
Organic matter.........	43.72	31.74

The former he regards as of the estimated value of £1 16*s*. 5½*d*., and the latter of £1 15*s*. per ton.

COMPOUNDS OF IRON AND ALUMINA (SULPHATED CLAY).

Bird's Process.—Six cwt. of powdered clay is treated with 120 lbs. of sulphuric acid, and the mixture allowed to stand for a week.

The following are places where the process has been used: —

Stroud (Gloucestershire). — This solution of sulphate of alumina and iron is used in quantity equal to 28 to 37 grains of mixed sulphates per gallon, at Stroud (population 8,000) in Gloucestershire, to defecate 200,000 gallons of sewage. The treated sewage is allowed to run into settling-tanks passing from one to another through straw filters, and finally filtered through coke filters. The sludge is dried and made into a manure by admixture with sulphate of ammonia and phosphate of lime.

The Stroud sewage was examined and reported on by the Rivers Pollution Commissioners in 1868, when a solution containing 6 cwt. of pulverized clay acted on by 120 lbs. of sulphuric acid was added to 200,000 gallons of sewage. They record the effluent as inodorous, but not of a high degree of purity. (See First Report, 1868, p. 58.)

Cheltenham.—Bird's process was adopted at Cheltenham in 1868. It was said not to be a success.

Northampton. — In 1872, Northampton sewage, which was then 1,000,000 gallons a day, was defecated with crude sulphate of alumina and iron, made by the action of sulphuric acid on a ferruginous clay. Three cwt. of chamber sulphuric acid were added to 2 tons of clay in a wooden trough, and allowed to remain in contact for a week. The solution was generally found to contain about 15 cwt. of a sulphated ferruginous compound. There were six of these troughs in use — the entire soluble contents of one trough being used daily. The flocculation was imperfect from the want of an efficient stirring apparatus. Moreover, the acid of the chemicals caused effervescence with the carbonates present, a scum being formed from the rise of the suspended matters. This, however, was kept back in the first tank by cross-bars. The sewage then flowed into a second tank, and finally over a weir into a channel a mile in length, when it was discharged into the river. The river itself was clean, the aquatic vegetation healthy, and fish abundant.

The samples given below are averages of many samples taken over 24 hours. The effluents generally were clear and inoffensive.

	Matters in solution.			Matters in suspension.		
	Total solids.	Oxygen required to oxidize.	Ammonia.	Total solids.	Organic.	Mineral.
Raw sewage.......	73.60	2.265	4.98	13.83	8.48	5.37
Effluent, 1st tank.	70.16	1.980	4.19	4.97	2.91	2.06
Effluent 2d tank..	70.65	1.243	3.247	1.74	1.11	0.63

About 400 tons of sludge were removed per week. This was mixed with sifted ashes (48 tons) and burnt refuse (20 tons), and found a market at 3*s*. per ton.

In 1875, the proprietors of Bird's process brought an action against the proprietors of the Coventry process for infringement, in which they were unsuccessful.

A process (*Cobley's* patent) similar to the one just described (the precipitants being said to consist of iron, alumina and carbon) is in use at Crewkerne, the precipitant being placed in a box with perforated sides, the sewage being allowed to flow through the box by which contact with the precipitant was secured. There is no stirrer, but sufficient mixing is said to be effected by the means described. The patentee states that the precipitant can be supplied (exclusive of a small royalty) at £2 per ton. A good effluent, which does not undergo putrefactive change by keeping, is stated to be produced.

At Hertford (population 9,000) the sewage is treated with a solution of sulphate of iron (1 part), lime (2 parts), and sulphate of alumina (2½ parts). It flows into subsidence tanks (seven in all, five being used continuously), and finally through a coke filter.

LIME AND SALTS OF ALUMINA (COVENTRY PROCESS).

Anderson, of Coventry, suggested the use of lime and an aluminous compound, prepared by adding 1 part of common sulphuric acid, mixed with its own bulk of water, to 2 parts of clay (shale having also been used). The mixture is to be set aside in a warm place until it appears white on the surface.

One pound of this mixture is to be well agitated with 100 gallons of sewage, and a ¼ lb. of lime (as cream of lime) afterwards added. He advises that the defecated sewage be allowed absolute rest for twenty-four hours, the clear effluent being then drawn off and the sludge removed.

Odling gives the following results by this proeess: —

	Matters in solution.			Matters in suspension.		
	Total solids.	Organic matter.	Ammonia.	Total solids.	Organic.	Mineral.
Raw s'ge.	42.77	8.33	0.77	89.74	51.66	38.08
Effluent.	56.28	6.30	0.84	1.61	0 91	0.70

Both Odling and Voelcker reported highly of this effluent, as thoroughly deprived of noxious qualities.

The sludge is valued by Voelcker at 30*s*. per ton. He gives the following analyses: —

Moisture.........	12.01	15.70
Organic matter.........	26.89	31.86
Phosphate of lime.........	2.60	2.55
Mineral salt.........	6.61	10.33
Silica, etc.........	51.89	39.56
	100.00	100.00
Ammonia......... =	1.39	1.22

At Coventry the use of this preeess was commenced in 1874. It has been ably supervised for many years by Mr. Melliss, C. E. There are, at the present time, four precipitating tanks worked on the continuous principle. The effluent flows through filter-beds occupying 9 acres, used intermittently, and is ultimately discharged into the River Sherbourne.

The sewage of Coventry is about 2,000,000 gallons daily, very foul, and much colored with dye refuse, etc. It needs far more chemicals than average sewage. The sludge produced is about 25 tons per day (90 per cent moisture). About 2 tons of crude sulphate of alumina (but of which two-fifths, being insoluble in water, is not put into the sewage), and 10 cwt. of lime are used daily. The cost for chemicals is said to be £1 14*s*. per 1,000,000 gallons, and the entire cost (including rent, capital on works, management, etc.) about £4 14*s*. per 1,000,000 (=1.8½ per head).

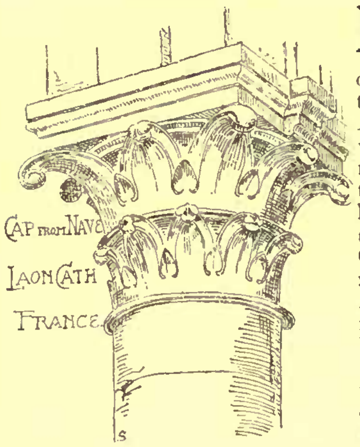
Formerly, one portion of the sludge was got rid of in a semi-dry condition at 7*s*. per ton, whilst another portion, dried and reduced to a portable condition, fetched £2 per ton. Some of the sludge was also "fortified" by added chemicals, and fetched from £5 to £6 per ton.

A similar process was also in use at Nuneaton from 1872 to 1876, when the arrangements between the Local Board and the General Sewage and Manure Company fell through, from some misunderstanding respecting the average daily flow. Nuneaton sewage is offensive, owing to the presence of manufacturing refuse. From

400,000 to 500,000 gallons were treated daily. The effluent was filtered through 2 acres of land. The yield of manure was about 1 ton daily. The cost was as nearly as possible the same as at Coventry.

[To be continued.]

THE LATE PRINCE TORLONIA.



EVERY morning during the last quarter of a century, just as the first streak of dawn broke upon the horizon, as the first bells chimed out the Angelus, the peasants on their way to the markets of the Eternal City, the workmen treading to their daily toil have met a little old man trudging with sprightly steps toward the Church of Our Lady of Loretto, close to Trajan's Forum. He was a peculiar-looking old man, not exactly seedy or shabby, but his garments, although they did not betoken indigence, were such as would be worn by one who evidently meant to get all the wear out of them that was possible. Yet peasant and artisan alike used to bow very lowly to him, and he would return their salutes most courteously, showing that he understood what a good thing it was to be on good terms with everybody. A stranger might have mistaken this personage for the servant of some ecclesiastical community, or perhaps for the overseer of some opulent family, and in the last they would not have been far out of the way, although when that old man died all Rome crowded to his obsequies, and the Libro d'Oro was fully represented around his coffin. The latter was deposited, according to high partrician privilege, upon the altar steps of the Basilica of the SS. Apostoli, where he laid in state robed in that livery of the pauper, the habit of the order of St. Francis, for he to whom were paid these honors of pride that ape humility was not only one of the wealthiest private individuals in Europe, but certainly the most remarkable among all in his acts of benevolence and charity — Prince Alessandro Torlonia, Duke of Musignano, Prince of Civitella-Casi, of Farnese, and of Fucino.

Everybody has heard of the name and the fortune of the Torlonia, the first of whom, Prince Giovanni, Stendhal has treated so cruelly with his pen dipped in gall, satirizing the young-born opulence of one who affected a species of haughty good-fellowship in his intercourse with his contemporaries, as if that affectation of familiarity could excuse his insolence to all who were less noble than he. Of very humble origin are the Torlonia, and only toward the end of the pontificate of Pius VI did the first banker of their family — then called Turlonia — come to be known, by his wealth amassed by contracts with the French armies during the wars of the revolution in Italy. In Stendhal's time the beginnings of those splendors dated back scarcely five and twenty years, where still might be seen at the corner of the Via Condotti and the Corso the little shop which, forty years before, was the unique domain of the millionaire's family.

It was not, then, to be wondered at if this delicate hypercritic did sneer at the parvenu, who, by his luxurious ostentation, eclipsed the most illustrious of the aristocrats, who entitled himself the Marchese di Roma Vecchia, and who told, as he pointed to the mirrors of his palace, how he had bought them for a mere song from a second-hand dealer with whom he passed himself off as the steward of *quel ladro di Torlonia*, of whom he could not say too much in dispraise. But Stendhal might have remembered — he who so passionately loved Italy, and so well knew her history — that the opulence of the patricians of Genoa and of Venice and of the most illustrious of all, the Medici of Florence, had trade for its cradle.

True, at Rome it was not quite the same thing, but the fruitful administration — to use no harsher term — of the property and the favors of the church is hardly more chivalrous and more heroic than commerce, and the Italian aristocracy, which does not share the disdain professed by aristocracies of military origin, is quite indifferent to what so aroused the German poet's imagination. The Florentine nobles still continue to sell by their concierges to the passer-by the produce of their vineyards and olive groves. The Ginori, allied to the Medici in the days of Lorenzo the Magnificent, manufacture porcelain and has no hesitation to fill an order for the least heraldic imaginable of utensils. And the Corsini? They produced a saint in the sixteenth century, as was then the fashion; they produced a Pope in the eighteenth century, as was then the bounden duty of every great family in Italy having a proper sense of its own importance, but, in the nineteenth century, the head of the Corsini is the President of the greatest of Italy's financial companies. The Italian nobility appreciates the rôle that it is set for; it is practical; it has good common sense, and instead of embarrassing its native land by whining over a past which can never be recalled, and privileges which have become extinct, it sets the example by the encouragement of progress. It considers itself as a guest at a banquet, to which any one can be admitted who is willing to pay his scot. And it is for this reason that the death of Prince Alessandro Turlonia, the grandson of the Roman mercer, has put into mourning the Orsini and the Doria, the Chigi, the Barberini, and the Colonna, those historic families which, within the last fifty years, have become, by marriage, the allies of those once humble tradespeople.

I think it was Mme. Sevigné who said that "nothing was so ruinous as the want of money." The converse is certainly true, and nothing enriches so much as wealth, which nobody can deny, as in spite of the proverbial good luck of the Torlonia family, and its unquestionable financial cleverness, an outsider has some difficulty in understanding how it is that the immensity of their outlay, apparently unproductive, should have not at least diked that Pactolus which rolls its golden flood undiminished by their prodigality since the opening of the present century. Palaces and villas filled with sumptuous furniture, museums peopled with statues, obelisks of Alpine granite, a monumental chapel at St. John Lateran, three churches magnificently restored, the two principal theatres of Rome rebuilt, immense archæological excavations, one of which uncovered an ancient circus, until then buried for ages; royal fêtes given in honor of the Roman aristocracy and of princely travellers; banquets at which plebeian guests sat down by thousands; charitable foundations too numerous to mention; all these are expenses, seemingly without other end in view than ostentation, which look like wasteful profusion, and yet to meet them it has sufficed that two successive generations should have produced in the same family two men endowed with intelligence of no common order, each of whom passed ten hours of every day of his life seated at his desk, pen in hand, absorbed in calculation.

Yet as success in every line is the lot of nobody, the Torlonia, fathers and sons alike, have always failed to realize that ambition which, next to the acquisition of wealth, has ever been their fondest dream. They hankered after the glory of the Medici; they aspired to immortality as the protectors and patrons of high art in the nineteenth century, and they have not succeeded. Everything due to the magnificence of the Torlonia lacks the element of good taste, and wherever appears their escutcheon bearing the two comets which a satirical herald gave to them as appropriate arms, never believing that their constellation could become one of the fixed stars — whenever anything emanating from their munificence appears, the passer-by, if he be of a refined turn of mind, would do well to look another way. Take, for instance, the Villa Torlonia, or the Via Nomentana, their most personal creation. It is the abomination of desolation predicted by the prophet. It is a union of the false Greek with the false Gothic. You go from one apocryphal coliseum to fancy ruins and thence to a grotto where pasteboard stalactites are encircled with tin ivy leaves. There, too, you are asked to admire the famous obelisks of Baveno, which bear on their pink granite the name of Torlonia, translated by a Jesuit into the sacred characters of Rhamses-Meiamoun. And the Olympus where stand whole regiments of statues! Words are wanting to express the contempt inspired by all this *lusso infelice*, as the Italians qualify a futile attempt to obtain that picturesque decorative effect which was the last quality of the artists of the eighteenth century that remained to the Seven-hilled City. Nothing can be imagined less artistic, more strained, more grotesque, and the only excuse to be offered is that the Torlonia were obliged to address themselves to their contemporaries. Sigismondo Chigi, the Torlonia of his age, was more lucky, when, to save his name from oblivion, he secured the aid of Bramonti and of Raphael.

It is probable that Prince Alessandro understood that this satisfaction of his *amour propre* was unattainable, for in the latter years of his life he abandoned the administration of his bank, ceased to build and to entertain, neglected the superintendence of the tobacco monopoly which he had managed for many years, and devoted himself wholly to that colossal enterprise which would have frightened the boldest speculator and which the Government even hesitated to undertake — the drying up of the Colano Lake, called in antiquity the Fucino.

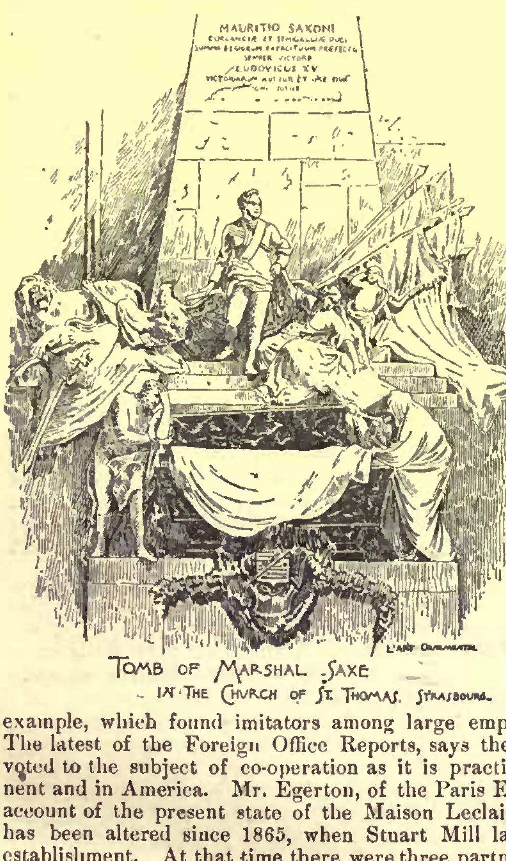
The Emperor Claudius, a great administrator and an indefatigable worker for the public weal, whatever may have been said against him by the pamphleteers of his time, who had created the port of Ostium and brought to Rome the waters which still bear his name, employed 30,000 slaves during eleven years to bore in the mountain an outlet by which the neighboring villages might be saved from those periodical inundations by which they were ruined. It was a big thing in the days of Claudius, and Suetonius has described the festivals by which its achievement was celebrated. But the successors of Claudius were careless, and with the decline and fall of the Roman Empire, the Lake of Fucino recommenced its devastations, which lasted 1,800 years, until a private individual accomplished what Cæsar dared not attempt and Claudius failed to do durably. At present the Lago di Colano, of which the surface area exceeds 34,000 acres, is entirely dried up, and on its site stand 400 farms, all bearing the escutcheon of the Torlonia. The completion of this gigantic enterprise assures to Prince Alessandro a place among the benefactors of his country, and it is entirely personal. In the beginning he allowed every one to believe that he was acting for a joint-stock company, modestly admitting that no one private individual could be wealthy enough or bold enough to take in hand a task so costly and so uncertain. But the truth soon leaked out, and the world soon learned that all the scrip of that pretended company belonged to the Roman banker. Perhaps you will admit that the Lake Fucino

enterprise is a good set-off to the story of the mirrors of Prince Giovanni, Stendhal's bug-bear.

This clever, lucky man died at the age of eighty-six, leaving no direct heir to his name, and this was the one black speck upon his sun. His wife, a Colonna of the elder branch, bore him two daughters, losing her reason and her life at the birth of her second child, who survived her mother only a very short time. He sought to marry the other to some one who would assume and perpetuate the patronymic of which he was so justly proud, but Giulio Borghese came forward as a suitor, and as he pleased the girl the old man yielded a reluctant consent. The Borghese are the Cobourgs of Italy. Their personal attraction and the dignity of their life, their palaces, their name so deservedly popular in Rome, make of them the predestined husbands of rich heiresses. And so it was that the Princess Anna Maria de Torlonia became the spouse of Don Giulio Borghese, Duca di Cori, and henceforward, like the Salvoili and the Aldebrandini of less high-sounding names, but of equally solid opulence, the Torlonia will become Borghesi.

Of all his gala equipages in the latter years of his life Prince Alessandro retained only the old-fashioned vehicle, with its old-fashioned lackeys, with its silver-gilt harness with gold everywhere that it could be stuck on, and, of course, with its inevitable coat-of-arms. In this antiquated coach were carted about the guests particularly recommended to him to whom he wished to do especial honor, and, as far as it could be perceived, men, women, and children began to bow and scrape, and sometimes to cross themselves devoutly, answering simply to the inquisitive stranger: "È la carozza del Principe Torlonia," but never telling how the Prince himself had not taken his seat within it for fifteen years, putting it at the orders of the Bambino of the church of Ara Cœli, who, although he still continues his traditional visits to women in childbirth, has reformed his equipages since 1870. The Bambino yet wears his diamond-embroidered swaddling clothes, but he relies upon his devotees for a lift when on the way to pay a morning call. — *C. J., in the New York Times.*

CO-OPERATIVE WORKSHOPS IN FRANCE.



TOMB OF MARSHAL SAXE — IN THE CHURCH OF ST. THOMAS, STRASBOURG.

A GOOD deal of attention has been given by political economists to the experiment in co-operation which was attempted in 1838 by M. Leclaire, a house-painter in Paris, having about two hundred men in his employment. Even in the first year his success was remarkable, and although he relinquished a large part of his profits, M. Leclaire was able, after a time, to acquire a handsome competency. John Stuart Mill says that M. Leclaire set a beneficent example, which found imitators among large employers in Paris. The latest of the Foreign Office Reports, says the *Architect*, is devoted to the subject of co-operation as it is practised on the Continent and in America. Mr. Egerton, of the Paris Embassy, gives an account of the present state of the Maison Leclaire. The system has been altered since 1865, when Stuart Mill last described the establishment. At that time there were three partners; viz., M. Leclaire and M. Defournaux, who each received 240*l.* a year for superintendence, and a Provident Society, made up of all the employés, represented the third partner. Each partner had invested 100,000 francs, but the employés received one-half the profits, although owning no more than a third of the capital. It was agreed that on the retirement of the private partners the whole of the goodwill and plant should become the property of the Provident Society. At present the employés appear to have the entire control of the Maison Leclaire, but another title has been substituted, for the establishment now is known as Redouly & Cie. The French of late appear to have a passion for obliterating names that were likely to be interesting.

The following is Mr. Egerton's report: —

M. Leclaire, originally a working painter, having started a workshop, determined not only to interest his workmen in the profits, but by degrees to educate them to be able to take in hand his whole business. His aim was that they should advance by practical proof given of their individual capacities.

He began in 1838 by a mutual-benefit society (Société de Sécours Mutuel), to which he made-over twenty-five per cent of the net profits. This fund was not only for aid in case of illness and for pensions, but was intended to produce a capital to be employed in the business itself.

Every workman invalided was given from this fund (unless his illness were caused by drunken habits or vice) 2 frs. 50 c. a day; this was increased to 5 frs. after 1881. The pensions were fixed at from 500 frs. to 1,000 frs., and were always granted in cases of accidents or serious chronic illness, or after twenty years of service to those over fifty. This pension was increased after 1881 to 50*l.* Half of the pension reverted to the widows or orphans. Thus in 1877 36,450 frs. were paid to twenty-four old members and eleven widows, and these pensions rose in 1881 to 46,800 frs., thirty-four pensions to members and ten to widows and orphans. In case of a workman leaving the house before he is entitled to pension he receives 20 frs., the amount of his subscription to the benefit fund, and 10 frs. for each year of active service. This last sum is increased to 20 frs. for the widows of members who have died in active employment. Notwithstanding these heavy charges, the fund possessed in 1877 a capital of 906,000 frs., which in 1883 had grown to 1,412,224 frs.

The co-operative part of the business itself is thus organized: —

Free or temporary workmen. Candidates for the nucleus ("*noyau.*")

The "*noyau*" comprises the associated workmen and employés.

The "*noyau*" and the candidates for the "*noyau*" form about a quarter of the total number employed, say about one hundred and twenty of the "*noyau*" and about one hundred candidates. Beyond five years of service in the house, there is no condition but good work, conduct, and capacity for admission to the "*noyau.*" The members of the "*noyau*" itself elect by simple majority of votes, after previous examination, and report those whom they judge fit to belong to it.

The members of the "*noyau*" have the following privileges: —

If the general council approve, they receive 25 c. per day in excess of the salaries given for similar labor by the City of Paris. This addition to their pay is not given at once, but at the end of the year. They name the members of the "committee of conciliation," which is charged with the order and inspection of the business, with giving advice, and with inflicting the prescribed penalties. They name the overseers, the new members of the "*noyau,*" and the two delegates, who have to examine, in concert with the president of the benefit society, the balance-sheet; and they have to see that the division of profits has been made in conformity with the statutes. (Publicity is necessary in all "sociétés anonymes.") They are entitled to the pensions above mentioned.

The two members who manage the house and represent it are chosen from and elected by the "*noyau.*" These managers of the business receive 6,000 frs. yearly, and 25 per cent of the net profits. The senior manager receives two-thirds of this, the junior a third. Beyond this the managers have no personal vested right in the house, and in case of death or leaving the house are simply replaced by election. The president of the benefit society may even move that they be replaced. Each of these two managers must be interested in the house to the amount of 100,000 frs.; but in order that the want of this capital may not be an obstacle, this amount may be formed by the accumulation of two-thirds of the profits due each year to the newly-named manager, and the manager who is replaced can only withdraw his share in proportion as that of his successor is made good.

The remainder of the common working capital, say 200,000 frs., is given as a deposit by the benefit fund. The house is, in fact, the property of the picked body of workmen which constitutes the "*noyau.*"

Twenty-five per cent of the profit goes, as I have said, to the managers, 25 per cent to the benefit fund, and the remaining 50 per cent is divided amongst the workmen and employés of the house, *pro ratâ* of their salaries. Practically, therefore, the workmen and employés are thus paid over 75 per cent of the net profits.

The proportion of the profits to the salaries grew gradually to 12, 14 and 16 per cent up to 1877, and in 1884 it reached 20 per cent, when the amount was 322,500 frs.; in 1882 the profits were 22½ per cent more than the total amount paid for salaries.

The "*noyau*" does not of course directly interfere in the general direction and daily management, which is in the hands of the two managers.

It is interesting to see the use made of their profits by the workmen. In the year 1877, out of 135 workmen 63 put their shares of profit in the benefit and savings funds, or in shares — capital invested in the house receives 5 per cent a first charge, but does not participate in the profits; 17 spent them on their families, 16 paid debts made during want of employment or illness, seven put them into small shops kept by their wives or children, and 1 paid the money he still owed for exemption from military service. This is demonstration of the saving tendencies of the workmen.

In the Commission of 1883 it was stated in evidence that 3,326,142 frs. had been distributed amongst those employed by this house, as shares of profits or bonus from 1842 to 1882.

The element of success was, according to the evidence, the formation of the picked intelligent body of workmen called the "*noyau.*" The idea of equality of pay would, it is said, be looked on by them as ridiculous. They had been at one time rather hampered by

agitators, but the men had soon the sense to see where their true interests lay, and broke with them.

Co-operation under a different arrangement exists since 1877 in the large manufactory of kitchen and heating apparatus at Guise, founded by M. Godin. It is known as the "Familistère" — a word that was probably derived from the "Phalanstère" of Fourier. In 1883 there were about nine hundred directly interested in the business of the establishment.

According to Mr. Egerton, the workmen are paid according to their capabilities, after free discussion before a council of their fellows.

The division, too, of profits is made on a graduated scale. Thus a first-class member (*associé*) — picked workmen of long service, of whom in 1883 there were seventy—receives twice as much; the second class (*sociétaire*) half as much again individually (there are one hundred such) as the "*participants*" or third-class members (of whom there were eight hundred).

M. Godin has found great advantage in this division of profits. The work has much improved, the hands much more careful to guard against mistakes, and that the interest taken in the business by the hands has much increased is shown by the constant new inventions and improvements made by the men. Since they were made partners, a great number of patents have been taken out by the "Familistère."

All the workmen have a portion of their pay and profits re-invested in the house, and by this system M. Godin the original founder of the business, is being gradually bought out of it, and he means that this system shall continue. It is more generally beneficial, he considers, that the buying out in rotation shall continue indefinitely, so that those who have long profited by the great advantages of the institution — and have in fact enriched themselves — should in time give way to the young and poor who are beginning. Naturally, of course, this process is slow, as the capital of the business is increasing.

M. Godin practically keeps a certain management of the business in his own hands, though theoretically the business is managed by three councils or boards, viz., the board of management which meets monthly, the business council which is held every week, and the council for the management of the buildings and the commercial business.

Enormous buildings have been constructed by the association, so as to lodge the hands and their families. Some of the members, more especially the second class or "*sociétaires*," are bound to live in these houses.

M. Godin, in his evidence before the Commission of 1883, gave very full details of the working of this remarkable and useful establishment, which is a complete partnership and co-operation of capital and labor. A branch of this "Familistère" has been founded near Brussels, and is successful.

The evidence given to the Commission of 1883 shows immense variety in the details of the systems adopted by the various co-operative societies, and by those firms where the profits are shared by the workmen; but all managers of houses, and those who have practical experience were agreed that the system of co-operation and of sharing profits puts an end to strikes and improves production and good relations. Some associations, as that of the opticians, even took active part with the employers of labor in opposing a strike.

There has been no case of disposition to strike for increased share of profits. M. Roberts, an important witness, scouts the idea of this as a future danger.

The objection of some heads of houses to their workmen sharing profits seems to proceed mainly from dread of the extra trouble of management and account-keeping entailed thereby.

Co-operative workmen, and those working for a share of profits, rarely ask for a Monday holiday, as do most other workmen; thus their houses are able to execute orders with greater rapidity. When there was a strike among the painters, the co-operative workmen at M. Leclaire's worked fourteen, and even more, hours per day without the slightest complaint.

SOCIETIES

THE T-SQUARE CLUB OF PHILADELPHIA.

AT the regular meeting of the T-Square Club of Philadelphia, held December 1st, the prizes were awarded as follows: 1st, Walter Cope; 2d, L. C. Hickman; 3d, Arthur Truscott.

The programme was: a stable with accommodations for four horses and a cow.

Fifteen designs were submitted, the average merit being high.

ART STUDENTS' LEAGUE, NEW YORK.

Professor Russell Sturges kindly gave the members and students of the Art Students' League an interesting talk on bronzes on Saturday evening the 4th. The period covered being from the early Greek discoveries down to the later Renaissances. The lecture being illustrated by stereopticean views and the Professor's complete collection of photographs.

COMMUNICATIONS

THE CASE OF MR. BALDWIN AND THE A. I. A.

Baltimore, December 7, 1886.

To the Editors of the American Architect: —

Dear Sirs, — Appreciating your refined sense of justice and sound judgment I venture to ask of you and the members of the profession who were not present at the recent convention of the A. I. A., held in New York last week, a suspension of judgment upon the, *if truly reported*, unjust and hasty judgment passed by the Convention upon me on charges preferred by a fellow member, until I have had the opportunity to disprove the acts which I scorn as I do the man who accuses me of them, and oblige, Yours respectfully,

E. F. Baldwin.

Baltimore, December 7, 1886.

To the Editors of the American Architect: —

Dear Sirs, — The enclosed letter, published in this morning's paper, explains itself.

December 6, 1886.

Editor American: —The report, as appearing in your issue of Saturday and Sunday, in regard to the Action of the American Institute of Architects, in session at New York, asking for the resignation of Mr. E. F. Baldwin, for "unprofessional practice," caused the utmost surprise and indignation to us and others of Mr. Baldwin's professional associates in this city. No official information of such action of the Institute has yet been received by Mr. Baldwin, and nothing is known of it here beyond what has appeared in the newspapers, as Mr. Frederick was the only Baltimore architect present at the time of the proceedings. The facts of the case between Mr. Baldwin and Mr. Frederick can easily be ascertained, we presume, from the evidence submitted to the Board of Trustees; but that such precipitate action should be taken by the Institute in regard to a member of such high standing as Mr. Baldwin, both as an architect and a man, without an opportunity for explanation or defence, and actually without his knowledge — on what might presumably be considered an *ex parte* representation — seems to us to call for decided protest, and a request to the public to suspend their judgment till the facts are better known. Very respectfully,

Wyatt & Sperry.

It is merely a public expression of our feeling in the matter, pending any more official action that the Baltimore Chapter may take later. Our opinion is shared by many others.

Yours respectfully, Wyatt & Sperry.

THE BOSTON STATE-HOUSE QUESTION.

Boston, Mass., December 9, 1886.

To the Editors of the American Architect: —

Dear Sirs, — I owe you one for a shy at our lovely home to which I am deeply attached. If the editor had looked at the ground behind the State House he would have seen that the "large vacant lot" is *not* "some distance beyond" the row of houses in the rear, nor is it "separated from it by other streets." But that houses and vacant lot are *one* solid lot, bounded by Mt. Vernon, Temple, Derne and Hancock Streets, separated by one narrow street from the State House, and could, without difficulty be joined to the present State House. If a particular editor objects to bridges — the street could be closed and passage deflected at Joy, instead of as now at Mt. Vernon (right angle). But the Paris public finds no objection to both foot and horse and 'bus ways through and under the Louvre, and I don't see why other cities should to similar passages.

Yours truly, Chas. G. Loring.

THE NASHVILLE M. E. CHURCH COMPETITION.

Nashville, Tenn., December 10, 1886.

To the Editors of the American Architect: —

Dear Sirs, — Referring to the competition for designs for the new West End M. E. Church, South, at Nashville, Tenn., I am this morning authoritatively informed that at a meeting of the Board of Trustees, last evening, action was taken reducing the amount of the prize for the design selected from $500 to $200. As I was responsible for the sending of the printed circular to you, I deem it my duty to inform you of this change.

Very respectfully yours, Olin H. Landreth.

BOOKS ON MILL CONSTRUCTION.

Philadelphia, December 11, 1886.

To the Editors of the American Architect: —

Dear Sirs, — Would you kindly inform me what are the best works on modern mill construction, more especially those referring to the system of slow-burning construction, the use of automatic-sprinkling apparatus, and systems of ventilation for mill buildings?

Yours respectfully, B.

[B. H. Thwaite's "*Our Factories, Workshops and Warehouses:* their sanitary and fire-resisting arrangements," published in 1882, by E. & F. N. Spon. Price, $3.50. C. J. H. Woodbury's "*Fire Protection of Mills and Construction of Mill Floors:* tests of full-size wood mill columns," published by John Wiley & Son, in 1882. Price, $2.50. — Eds. American Architect.]

A BOYCOTT AGAINST THE *AMERICAN ARCHITECT.*

A CORRESPONDENT at Coldwater, Mich., sends us the following newspaper clipping and asks whether the Knights of Labor have declared a boycott against the *American Architect.* The only thing in the petition that really surprises us is that the L. A. 4571 did not include in its petition a request that the $2.40 thus, for the moment, saved to the city should be paid in to the treasury of that honorable body.

"The following resolution was passed by the K. of L. Thursday evening, December 9:

"Resolved, By L. A. 4571, that we urge upon the City Library Board the propriety of discontinuing the *American Architect and Building News*, which merely gratifies the eyes of a few people, and use the money thus saved in subscribing for four labor papers to be kept on file at the Public Library; we recommending John Swinton's Paper, New York, at $1 a year; The *Industrial News*, Toledo, O., at 60 cents a year; The *Chicago Express*, at $1 a year, and the *Chicago Knights of Labor*, at $1 a year."

NOTES AND CLIPPINGS

FIRE-EXTINGUISHING POWDERS. — A German physicist directs attention to a method of extinguishing fires which was first brought to public notice several years ago. He recommends for closed places, where the use of water or other liquids would be likely to do great damage, a dry compound which, by its burning, absorbs the oxygen and quickly renders combustion impossible. The compound is composed of powdered nitrate of potash (saltpetre), 59 parts; powdered sulphur, 36 parts; powdered charcoal, 4 parts; colcothar (brown-red oxide of iron), 1 part. This preparation is one that can be cheaply made. It is recommended that it shall be, when thoroughly dried and mixed, put up in tight pasteboard boxes holding about five pounds each, with a quick fuse in the side of the box — protruding six inches, with 4 inches inside — to facilitate and insure lighting it. — *The Iron Age.*

WOMEN AS ARCHITECTS. — Mr. C. Harrison Townsend writes to the *Pall Mall Gazette* of October 28 as follows: —

It has of late been largely agreed that there are many fields of work, hitherto complacently occupied by men only, which there is every reason to suppose could be as worthily filled by women. In making fresh suggestions in this sense I would say that my remarks have more direct reference to the girl and the young woman of the middle class than to those of the artisan class. What really valid objection is there to asking her to become a "draughtswoman," and in due course an architect? Surely, an occupation such as the preparation of architectural drawings, requiring neatness and delicacy of touch, attention to detail, patience, and care, is one which would seem at first blush more likely to find its proficients among women than men. Let us, then, look into the course of training that prevails, and see if it offers any considerable bar to the adoption by women of architecture as a profession. In brief, the routine is as follows: A youth on leaving school — with an aptitude, more or less, for the profession — is articled as pupil for four or five years to an architect to whom he pays a premium. This is, of course, in proportion to the position and repute of the architect in question, but may be stated at from a hundred pounds to four or five times that amount. As with solicitors, so among architects, the pupil is supposed, by having "the run of the office" to acquire an intimate knowledge of its work — design, draughtsmanship, knowledge of materials, official routine, and so on. If a young fellow of parts, he soon begins to "feel his legs" and to understand his work, and, if wise, supplements his office instruction by attendance at the admirable classes of the Architectural Association and elsewhere. At the end of his articles he is qualified to dub himself a "junior draughtsman," in which capacity he claims, as salary, from a pound to two pounds a week. A couple of years should then see him a draughtsman proper, and in a position to obtain three, three-and-a-half, or four guineas a week. In many cases, of course, thanks to such "backing" of his friends as he may be fortunate enough to get, the lucky pupil can set up on his own account immediately his articles are completed. In this routine which I have briefly sketched there are only two objections that stand in the way of its adoption by women. Against the first, which is the "commingling of the sexes" caused by the admission of women as part of an ordinary office staff, we can adduce American experience. Here they are frequently employed as type-writers and so on. As an illustration, I may mention that the Government clerks in Washington number about 15,000, of whom 4,000 are women, and that "it is often the case that young men and young women have desks side by side." (See *Pall Mall Gazette*, September 27.) But even should conservatism insist vigorously in this respect, we can at least compromise with it, and suggest a "women-clerks' room" as a solution of the difficulty. The second objection is the difficulty women should experience as regards the inspection of buildings and the necessary mounting of scaffolding for that purpose. While reminding the objector that women-decorators have been known to work for days on scaffolds, and that there are such things "as divided skirts," I would say that I am more particularly suggesting that women's work in an architect's office should be "drawing-board work," such as ornamental and other detail drawings, competition, sets of plans, schemes of color decoration, and perspective drawings. The simpler department of tracing has, I am told, been tried, and with some success, by the Ladies' Tracing Office in Westminster; and other ladies besides the Misses Garrett, have taken up decoration work, and a certain amount of architecture connected with it. My plea is for a further advance on the part of women into a territory of which there is no reason that man should occupy the whole.

TRADE SURVEYS

CONSIDERING the extraordinary industrial activity of the past four months, it is not to be wondered at that so much capital should be now seeking employment in the multifarious reproductive channels. At the same time that our own industries are preparing for a general advance, we learn that the industries of Great Britain and of Europe are emerging from a more or less general depression in which prices declined to cost, and much capital was, for a long time, rendered unproductive. The advance on both sides of the water at the same time is an accident. The conditions surrounding and underlying the trade and industries of both countries are dissimilar in many respects; in some few features they are like. The question of the permanency of the general upward tendency concerns us most. The strength of the British and European situation lies in the extending and expanding colonial requirements. The strength of the American situation lies in the extension of our railway system. This improvement derives strength from a variety of sources, but its strongest foundation, apart from the fact of heavy railroad construction, is in the diversification of our industries.

Such frequent notice has been made of the flow of industrial capital into the South that it has become an old story. It should not be so because the outflow or inflow has assumed the proportions of nothing but a rivulet compared to what it will be during the next ten years. The Southern people are only beginning to understand the real and enormous value of their inheritance. Northern and foreign capital is picking up the most eligible sites, the most valuable tracts, and is taking possession of the most desirable lines for transportation. It matters not, of course, from whence comes the capital or the men which bring about these great social and industrial changes. The fact that this movement is of greater importance than the bulk of newspaper readers are accustomed to regard it is the point to which attention is directed. It may sound like a prediction, but it is based upon facts, to say that the opportunities for the investment of capital during the next four years will be out of all comparison to the opportunities that have heretofore existed. These opportunities will not be confined to our own country or continent, but will be presented throughout the civilized world, and will be mainly directed to the more liberal provision of facilities for cheap and ready intercourse. The general condition of industries throughout the world is improving. Great Britain is rising out of a depression which vexed the oldest heads of trade and commerce. France and Germany have been expanding their productive capacity and leaving their old competitor behind in several markets of the world. American nick-nacks and ironmongery have been leading British products in Europe. That this complaint will grow in weight must be apparent to any one who is familiar with the wonderful development of the smaller industries in this country, and particularly those connected with the hardware, iron, implement and tool trades. Little industries are springing up in these branches where taxes, labor and power are cheap, and where the increasing efficiency of machinery smile at the dictation of trades-unionism. Our railway mileage, so far this year, foots up 7,000 miles against 2,700 up to same time last year. The side tracks and repairing requirements will amount to about forty or fifty per cent of this total, increasing it to that extent. The reported railway earnings are acting as a stimulant to railway enterprises to be undertaken during the coming year. The new syndicates were formed a few days ago in New York looking to the inauguration of railway construction enterprises intended more to develop territory in the Southern States than to construct long lines or trans-continental lines. The new investments will be directed to the development of agricultural, mineral and timber resources. The pig-iron production is a little over 123,000 tons per week. Prices have been advanced to $20 and $19 for foundry irons and to $17 to $18 for forge irons. Steel rails have been advanced to $36 at mill and old rails to $25 at tide water. English steel rail-blooms are $4 higher than they were four months ago, and all kinds of iron and steel material, excepting nails, have reached an advance which they will hold. Nails are weak and a proposition was made a few days ago to restrict production between now and March 1. The Eastern and Western nail-makers will probably meet shortly in New York or Philadelphia to agree upon a restriction of output. The lumber trade will hold the firm prices that have been reached, but the expectations of some of the sanguine dealers both East and West are doomed to disappointment because of the heavy supplies that the industrial activity of the past few months has stimulated. There is throughout all the country a strong desire to take advantage of the coming heavy demand and good prices. The textile-goods manufacturers feel in but little danger of overdoing the market, and it is given out that they will begin work full time throughout the New England States in January. The hardware manufacturers feel similarly encouraged, and a note should be made of the fact that in spite of the very heavy importations of foreign hardware and cutlery, American enterprise has increased factory capacity, and expects to come in successful competition with many of the lines of goods that have been controlling our market during recent years. The coal producers have increased their facilities at least ten per cent this year, according to safe authority, by the opening of mines along the lines of several railroads in the West and South. The latest opinions expressed by the leading architects East and West confirm the opinions all along expressed as to the active character of winter work looked for. Builders have made liberal contracts for material and the manufacture of small machinery and motive power have increased their orders since the 1st of December. There is very little uncertainty as to the character of next year's building operations. An immense amount of house and shop capacity will be wanted, and it will be supplied with more confidence than it was supplied this year. Building material will be, if anything, cheaper next year. The lumber dealers would be glad to put up prices, but in this they will fail. The coal-producers would be glad to combine prices up ten per cent, but while there are probabilities of this the risks overbalance. The producers of all kinds of shop and factory goods are living in the hope that spring prices will enable them to accumulate wider margins than they did this year. Three months ago there were probabilities that such would be the case. Since then the tide has turned. Too many wheels have been set turning. The increase in steam capacity has been beyond all precedence, and consumers in every channel of activity can rest assured that the period of high prices will be of very short duration. Production will be crowded in every industrial channel. It is possible that for a while higher prices will be held in steel, iron and for certain lines of well-protected goods, protected both by duties and by patents, but taking the general production of the country the increase in output will save it from higher prices than can be safely maintained.

The American Architect and Building News for 1887.

A PRELIMINARY PROSPECTUS.

It is not desirable for a journal which tries to place before its subscribers fresh and seasonable reading-matter to present a too-complete syllabus of the discourses which the editors propose to bring before them during the coming year, therefore, we will say only that we have in preparation the following series of valuable papers: —

"**Building Accidents**," a series of papers treating of every class of accident that may befall a building, each class being considered by that writer whose opinion on the subject we consider likely to be most valuable. As our arrangements are not yet perfected we are unwilling to publish the, at present, incomplete list of contributors.

"**How the Conventional House may be made Picturesque**," a series of illustrated papers by Mr. H. Edwards-Ficken, architect. Those who are familiar with this gentleman's decorative work and with the facility with which he can interpret in line his ingenious conceptions will understand that these papers will have more than a "popular" value.

"**Elevators: the Features common to all Makes and their Relation to Planning and Construction**," a series of illustrated papers by an expert.

"**Hints to Builders**," a series of practical papers on construction addressed to students by W. H. Brown, author of the "*Arch, Vault and Dome*," "*History and Principles of Decorative Art*," "*Buhl Work*," etc.

"**The Water-supply of Buildings**," an illustrated series of articles by John Pickering Putnam, architect. The publication of this series, which was included in the programme for last year, we have found it desirable to postpone until now.

Fine Art Exhibitions. Mrs. Schuyler Van Rensselaer will, as she has done during the past ten years, keep our readers informed as to what artists and amateurs of art find of most interest in the galleries and elsewhere. Amongst the earliest papers from her pen will be some notes on the "**Works of Augustus St. Gaudens, sculptor.**"

Other articles on the "**History of Decoration**," on "**Cement and Iron in Construction**," on "**Railroad Stations**," etc., are also in preparation.

The following series of papers, the value of which has been shown by the portions already published will be continued through the greater part of the year: —

"**Architect, Builder and Owner before the Law**," by T. M. Clark, architect.

"**Safe Building**," by Louis De Coppet Berg, architect.

"**Early Settler Memorials**," by Truman H. Bartlett, sculptor.

"**Ancient and Modern Light-houses**," by Major D. P. Heap, Secretary of the U. S. Lighthouse Board.

The manner in which topics of current interest will be treated should be too well-known by this time to require description.

ILLUSTRATIONS.

Gelatine Prints.— The number, quality and character of these attractive plates will not fall below the standard of those already issued.

Rotch Travelling Student Sketches.—The mass of these sketches in our hands shows that these plates — which add so greatly to the value of the Imperial edition — will be no less interesting in the future than they have been in the past.

Old Colonial Work.— Measured drawings of Old Colonial work in Virginia and Maryland will be furnished, with descriptive text, by Mr. Glenn Brown, architect.

Etchings.— The photo-lithgraphic reproduction of choice architectural etchings will be continued at regular intervals.

Photo-Caustic reproductions of foreign architectural subjects will receive rather more attention than during 1886.

Contributed Illustrations will be as varied and interesting as circumstances permit.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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CONTENTS

DURING the past year only one subscriber has expressed himself as being dissatisfied with the Imperial edition as an equivalent for the subscription price, and seven months afterward the same subscriber notified us that his first impression was a mistaken one, and in the handsomest way possible expressed approval of our efforts. On the other hand we have been in constant receipt of complimentary letters from other sources. We take these statements as an indication that the Imperial edition is to become the largest and most popular of the several editions which we publish, and the inference we draw is that many more will change their subscriptions from the cheaper editions to the Imperial edition, than will abandon it to return to the less expensive ones. As there is no possibility of gauging the size or duration of this movement, we expect to find our mailing-list thrown into more than ordinary confusion for a while. We can only hope to minimize the mutual discomfort to our subscribers and ourselves by urging those who intend to make a change in their subscriptions to notify us of their decision during the current week, so that we may be able to regulate the size of the edition as closely as practicable. To the subscribers to the Regular edition, we will point out that one of the features which distinguish the Imperial edition from that with which they are already familiar is the inclusion in it of gelatine prints such as the view of the Church of the Holy Spirit published in this issue.

A RATHER singular case was recently decided in Massachusetts, in which a firm of architects brought suit to recover payment for professional services rendered by request to a certain church society. So far as we can make out from the published accounts, the facts seem to be that the plaintiffs, with other architects, submitted designs in competition for a church building. Their design found favor in the eyes of the building committee, and they were requested to make working plans and specifications, and did so. It was not pretended that they were expected to do the work for nothing, but the witnesses for the church testified that the architects agreed to do it for one hundred dollars, and that a vote was passed by the church committee or corporation, authorizing the expenditure of this sum for the purpose, the record of which was read to the architects. One of the architects, on the other hand, who had represented the firm in the negotiations, testified that he had never agreed to do the work for a hundred dollars, and was not informed of any vote or resolution of the representatives of the church which implied that he was expected to do so. However that may have been, before any steps were taken toward carrying the plans into execution, the committee, in accordance with that proclivity of non-professional committees to which we have so often called attention, becoming a little satiated with the plans they had already obtained, began to turn their eyes toward the dazzling brilliancy of the fame of another architect, and finally threw overboard the people whom they had already put to so much trouble and expense, and made a contract with the more distinguished man to make designs for their building. The previous architects then claimed their pay, setting the amount due them at nineteen hundred and forty-five dollars. The defence set up was that of a contract to do the work for one hundred dollars, and the case seems to have turned upon the credibility of the architects and the witnesses for the church, who made directly contrary assertions in regard to this contract. It must be difficult to ascribe perjury to a church committee, but the jury seemed to have reasoned that an architect who agreed to do nearly two thousand dollars' worth of work for one hundred, and then swore that he did nothing of the kind, must have been not only a perjurer but a fool, which was even harder to believe, and they struck a balance by awarding the architects one thousand and ninety-four dollars and eighteen cents. The truth seems to have been that the difference arose from a misunderstanding on both sides as to the meaning of the negotiations about the making of the working-drawings. To the church committee, as to most people outside the profession, it probably appeared a small matter to make scale drawings and "rough draughts" of specifications, sufficient for estimates, and it is not improbable that in describing what they wanted they omitted to state exactly the details which they supposed the architect's experience would enable him to supply for himself. To the architects, on the contrary, the expression "quarter-scale drawings," or plans and specifications for estimates, unquestionably suggested the minute and tedious study, the weighing of two inches here and six inches there, the points of economy of masonwork, of provision for heating and plumbing pipes, of head-room for stairs, of interior and exterior effect, and the myriad of other things which, as architects know, must be thought over in making the quarter-scales, and it probably no more occurred to them that they were expected to do all this for a hundred dollars, than it did to the committee that they would be called upon to pay two thousand for what they would naturally have imagined to be a light afternoon's work. When they came into court, each side made its statement about its own ideal of the subject-matter of the services rendered, and each side suffered something because it had not been careful enough in the first instance to see whether the two ideals agreed.

IN the death of Mr. Edgar Corrie Curtis the profession of architecture in Boston loses one of its best-known and most popular members. Mr. Curtis was born in Boston, and graduated at Harvard College, we believe in the class of 1869. Several years passed after his graduation before he made final choice of a profession, but when he had made up his mind to devote himself to architecture he entered upon his work with zeal, spending some time as a student in Boston offices, and two years ago in the *atelier* Vaudremer in Paris. On his return from Europe he went into business on his own account, and conducted, until a few days before his death, a quiet but steadily increasing practice. Being naturally of a modest and unassuming temper, and possessing by inheritance an independent income, which relieved him from the necessity of calling attention to his own merits, he was known in the profession as a man rather diffident of his own powers, but very faithful and painstaking in carrying out commissions entrusted to him, and endowed with admirable taste, while his amiable disposition won him the sincere regard of his associates. Most of his work was in city houses, where his habit of careful study was particularly valuable; and many pretty and delicate bits of detail, now that their author's short career on earth is finished, will be regarded by their owners with special interest, as memorials of one of the kindest and most honorable of men.

ACCORDING to the New York papers, work on the Hudson River tunnel is likely to be resumed within a few months, and in less than two years it is hoped that the whole will be completed. As most people know, there are to be two parallel tunnels, of which one has been constructed for about a third of a mile, and the other for about six hundred feet, the whole intended length being fifty-six hundred feet. Both tunnels are now filled with water, but it is believed that neither of them has suffered any material injury since the work was abandoned. It seems strange that so important an undertaking, and one which promised so sure a return, should not have been completed long ago; but if we understand the accounts, the main difficulty seems to lie, not in finding funds to carry it out in a legitimate manner, but in floating a huge financial scheme, based primarily on the tunnel, but involving a prospect either of enormous profits or enormous losses on those who are induced to participate in it. According to the New York *World*, about eleven hundred thousand dollars has already been expended in securing the necessary legislation, charter

privileges and right-of-way, and in building the existing portions of the tunnel, and it will cost about twice as much more to complete both tunnels ready for service. This will make a total of three million three hundred thousand dollars, which is certainly not a high price for so useful a work. The capital stock of the company is, however, ten million dollars, and bonds have been, or are to be, issued for an equal sum, so that the fictitious valuation at which the securities are to be put upon the market is twenty million dollars, or more than six times the actual cost. Of course, there is nothing illegitimate in this, but there can be no doubt that a large part of the profits of the capitalists who get into the company "on the ground floor" must be made by selling stock hereafter to people who know nothing of the cost of the tunnel, or of the amount of the capital and bonds, and who innocently imagine that a dollar in securities stands for a dollar expended in construction, so that stock or bonds at half the par value in a completed and successful enterprise must be sold at a great loss instead of an enormous profit. According to the ideas of the general public a man who should buy land and build a house, at a total cost of three thousand dollars, write a mortgage on it for ten thousand, and sell the mortgage to an unsuspecting widow, and then sell the equity in the estate for ten thousand more to the trustee of a family of orphans, would be a subject for the attentions of the grand jury; and the truth that the same sort of financiering is practised on a great scale, and that mortgage bonds amounting to three times the cost of the mortgaged property, with stock representing the value left after deducting the face of the bonds, can be, and are sold with impunity side by side with stocks and bonds representing actual cost, is just beginning to be perceived. We wish all success to the engineering scheme of the Hudson River Tunnel, and appreciate thoroughly the skill and economy with which the work has been carried on so far; but tunnels into the pockets of "small capitalists," or, in other words, of the industrious and saving citizens who suffer most of the loss by the collapse of financial bubbles, do not belong to the class of scientific enterprises, and we should not be sorry to see the ownership of the line absorbed by the railway companies, who have an obvious interest in keeping it under their own control.

A CURIOUS example of a contractor's ingenuity in extracting a profit from rather unfavorable circumstances has just formed the subject of a judicial decision in New York. Some time ago the Department of Public Works of that city advertised for bids for opening a certain street in the rocky district about Riverside Park. The engineers employed by the Department made their cross-sections as well as they could, and estimated that nineteen hundred and thirty cubic yards of earth, and twenty-one thousand five hundred and forty cubic yards of rock, would have to be removed, and the bidders were informed of this estimate, although, as is usual in such matters, their tenders were to be made at so much per cubic yard for excavating each sort of material. At that time the ordinary cost of removing rock was about a dollar and a half a yard, and of removing earth about forty cents, so that the whole work, according to the engineers' quantities, ought to cost about thirty-three thousand dollars. As it happened, however, there was in the city a shrewd contractor named Brady, who, probably by the help of a private and personal survey of the ground, although this is not proved, conceived a little plan which he proceeded at once to put into execution. As the laws regulating the awarding of contracts, which are otherwise tolerably strict, do not prescribe that the bids shall resemble any particular standard, while they do say, we believe, that the contract must be awarded to the lowest responsible bidder, Mr. Brady made the remarkable offer to remove all the rock for one-quarter of a cent per cubic yard, or less than one-tenth of the proper price, and the earth for eight dollars a yard, or about twenty times the usual price. Taking the engineers' quantities as a basis, the whole work at these figures would cost fifteen thousand five hundred dollars, while at the regular rates it would have amounted, as we have seen, to thirty-three thousand. It is hardly necessary to say that no one else had made any tender to do the work at less than half price, and the Commissioner of Public Works, not being at liberty to award the rock excavation to Mr. Brady, and the earthwork to some one else, and being obliged to accept the lowest bona-fide tender, had no choice but to conclude a contract with Mr. Brady, although he was sharply criticised for doing so by the newspapers opposed to him in politics.

AS the work went on, it turned out, as Mr. Brady probably foresaw, that there was much less rock and more earth to be excavated than the engineers had estimated, and when the street was completed, the inspectors for the city certified that ten thousand eight hundred and thirty-one yards of rock had been removed, at one-quarter of a cent a yard, and fourteen thousand, six hundred and sixty-seven cubic yards of earth, at eight dollars a yard, bringing the total bill to twenty-seven dollars for the rock excavation, and one hundred and seventeen thousand three hundred and thirty-six dollars for removing the earth. The cost of the whole actual work at the average market prices would have been twenty-two thousand dollars, so that Mr. Brady's operation brought him in a net profit of ninety-six or ninety-seven thousand dollars, although his bid was less than half of what the engineers considered the job to be worth. Payment under the contract was made from time to time as the work went on, until the contractor had got about half his money, but the city officials then refused to pay anything more, and Mr. Brady brought suit for the balance. On the first trial the court seemed to think, as would, probably, most other persons, that the errors of the city engineers, joined with the unfortunate rigidity of the laws regulating contracts for public work, had given Mr. Brady an opportunity which he had simply taken advantage of, and which had turned out more profitable for him than he had perhaps expected, and as there was no evidence that Mr. Brady had been guilty of any fraud or conspiracy against the city, he was entitled to the fruits of an operation which had nothing in it contrary to law, and involved a considerable risk to the contractor. More recently, however, the counsel for the city brought forward new evidence, to the effect that Mr. Brady, having found in the excavation a large quantity of friable rock, had it powdered by various processes, and removed it as earth; and as this seemed to indicate that a fraud had been practised, a new trial has been ordered. We should not wish to prejudge the case, but it is to be hoped that a desire to save the city's money will not lead to an unfair decision of the purely technical question of the distinction between rotten rock and earth. A great deal of the upper end of Manhattan Island is composed of rock so decomposed that it cannot be effectively blasted, while it is too firm to be shovelled without first loosening with the pick. Such material as this is not, we think, generally considered rock by engineers, and a judicial decision to the effect that it should be so considered would be likely to affect a large number of private contracts. It is not probable that the city inspectors allowed Mr. Brady to class as earth any material which could not be attacked with the pick, and there could, perhaps be no better distinction than this between earth and rock in excavation.

A NEW sort of cartridge, according to the *Revue Industrielle*, has been devised for blasting in coal mines where there would be danger of setting fire to the coal, or to the inflammable gases contained in it, by the use of ordinary cartridges. The essential part of the new system consists in surrounding the explosive part of the cartridge with water, which completely prevents any appearance of flame, and consequently renders the kindling of coal-dust or hydro-carbon gases, by the explosion, impossible. The explosive used is Nobel's nitro-glycerine jelly, which is placed in a tin tube, which has three flanges on the outside. A casing of water-proof paper just large enough to admit the flanges is slipped over the tin tube, and the space between the two enclosures is filled with water, and sealed in some simple way, thus completely enclosing the inner cartridge. The blast is fired by means of electric wires, previously inserted in the tubes, and the explosion, if the charge is light, takes place without smoke or flame. With a heavy charge smoke is produced, but no flame. In blasting, the new cartridges are said to bring down the coal less broken than by the old process, and it is quite possible that the water serves to equalize the shock over the sides of the drill-hole, and thus to apply the force of explosion more effectually; just as the water-shells, which were made in England ten years ago for military purposes, were found to be rendered more efficient by the equalization of the explosion of the charge by the water which filled the remainder of the interior, so that, instead of bursting into three or four pieces, which were thrown to a great distance, the water-shells flew into a great number of small pieces, which were scattered in every direction over a small area, exerting, within that area, a most destructive effect. So completely does the water-envelope prevent the development of flame that a cartridge, on being placed in the middle of a heap of gunpowder and fired, simply dispersed the powder without lighting it.

THE MECHANICS OF THE GIRDER.[1]



UPPER PART OF MYSTIC TREE, FROM NIMROUD. ARTS DECORATIFS

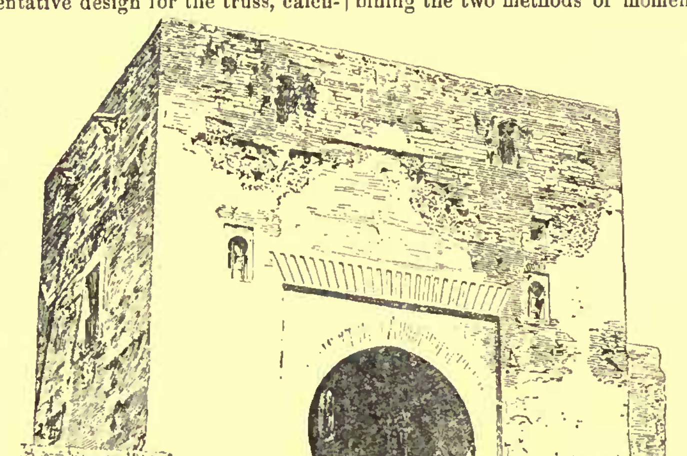
UNDER this title has recently appeared a book, published after the death of its author by his family, which contains a very clear and able exposition of a novel method of dealing with calculations for beams and bridge trusses. Unfortunately, the author's work was interrupted before he had extended his method to the full consideration of arched girders and other roof trusses, but he had prepared formulæ for these, as for all other possible classes of truss, and the application to these of the principles of the detailed examination which he makes of girders with parallel chords can be made without much difficulty. The theory which Mr. Crehore took for his guide in laying out a new path through the familiar field of statics as applied to framed structures was that if the conditions of the greatest allowable stress in the materials, the general type of truss, and the span and load were given, it ought to be possible to calculate directly the most favorable proportion between height and span, the best number of panels, and the sectional areas of top and bottom chords, and of web members, without resorting to the laborious and unscientific practice of sketching out a tentative design for the truss, calculating the strains and necessary dimensions for that particular form, and then modifying by successive experiments, until the designer's patience is exhausted, and he cuts the knot by adopting an approximation, more or less near, according to his skill and perseverance, to the best and most economical form, which, if the new theory were well founded, it would be possible to deduce by one operation from the conditions given.

Unlike Michael Angelo, who, as we read, on looking at a block of marble discerned a beautiful figure therein, and immediately fell upon it with a sledge-hammer so violently that he filled the air with chips of stone in his haste to disengage the lovely image before the vision faded, Mr. Crehore, who sees, as we may say, for every span and load the ideal truss which would fulfil the requirements with the minimum of weight and cost, makes no such undue speed in bringing his ideal to light as to confuse and distract his readers, but, beginning at the most elementary principles, he develops and illustrates his theory step by step, in such a way as to make his book easy of comprehension and practically valuable to any one who knows enough of the subject to undertake the computation of bridge trusses by any method; and, while his calculations, involving more unknown factors than the tentative ones based on arbitrary assumptions, are necessarily long, he is careful, after demonstrating his formulæ, to collect and tabulate them in such a way as to facilitate their use as much as possible.

Nothing could be simpler than the introduction to the new method. Beginning with the parallelogram of forces, which leads to the triangle and polygon of forces in the usual way, examples are given to be solved trigonometrically, and the same system is then applied to the moments of given forces, acting in specified directions and with given lengths of lever arm. This prepares the way for the study of a semi-beam, not loaded simply at one end, as it is usually first treated in books on applied mechanics, but subjected at once to a concentrated load at a certain point, a distributed load between two other points, and an oblique pressure at a fourth point, and a series of general equations is easily deduced for the moments at any section under any condition of the three external forces to which the semi-beam is subjected. It will be observed that the three external forces given represent pretty well the forces which are likely to act upon the members of a truss, and the way in which these simple equations lead to the more complex ones applicable to trusses may be, perhaps, dimly perceived.

The next step is to the consideration of a beam supported at each end, and subjected at once to vertical and oblique forces, and in the same way a series of equations is deduced for the moments at any section, under any condition of the loads, and the field of observation is enlarged by means of examples requiring the calculation of the moments at a series of points on the beam spaced at equal distances, resulting both from quiescent loads and from the movement of a given live load over the beam. This regularly divided girder, subjected to vertical and oblique strains, both shifting and quiescent, represents, for certain purposes, in miniature, a framed truss, divided into panels by the web members, and, as before, the equations derived from its consideration are tabulated for future reference and amplification. The next step is to regard the beam of the previous chapters as a framed structure, composed of members making certain angles with each other and with the horizon, and, after ascertaining the moments due to given vertical loading at certain points, the forces in the members of the truss meeting at that point are calculated by reversing the processes of finding the resultant moment of a number of forces acting in a plane.

At this point it becomes necessary to take into account the shearing forces which act in a beam or girder, and the proposition that the shearing strain at any vertical section of a girder is equal to the algebraic sum of the vertical components of all the forces impressed on either side of the plane of the section is made the basis of new formulæ, by which the strains in all the members of a framed girder may be determined from the given shearing forces alone. By combining the two methods of moments and shearing forces it is thus obviously possible to compute from given vertical loads the strains in all the pieces of a truss of any desired pattern subjected to those loads, and nothing more is necessary but the application of the ordinary facts of the resistance of the materials used to learn the dimensions required for each member under varying conditions.



Tower of Justice — Entrance of the Alhambra, Granada.

In applying these principles to actual examples, Mr. Crehore makes an ingenious classification of all possible trusses, according to the angles which their chords or web members make with the horizon. With regard to the inclination of the chords, the top chord or the bottom chord, or neither, or both, may be horizontal, giving four possible conditions; and with regard to the web members, one portion, or the other portion, or neither, may be vertical. The combination of these two sets of conditions gives twelve classes, under one of which every truss must come, and the book then goes on to discuss the trusses of each class. It would take too long to follow out the steps by which the principles of the method are applied to the various examples, and extended to the computation of deflections and wind-bracing, but the practical character of the whole discussion may be illustrated by mentioning one of the examples, in which the problem is to find, *à priori*, "the best number of panels, and the best height, for the two wrought-iron Pratt-truss girders of a highway through bridge of one hundred feet span, eighteen feet wide between the centres of the chords, under a uniform rolling load of two thousand pounds per running foot, in addition to the weight of the bridge. Also, to find the weight of the bridge corresponding to these best values, taking account of wind pressure." The computation is carried out according to the formulæ previously found, using the ordinary constants and factors of safety, and at the end another calculation is made of the comparative cost of the division and height which are best in theory with a different division and height, which would require heavier wooden floor timbers, but less iron in the trusses, and it is found that on account of the cheapness of wood as compared with iron, the minimum of cost is obtained with a bridge which would be about three per cent heavier than the one which would take the least total weight of material.

[1] "*Mechanics of the Girder*": A Treatise on Bridges and Roofs, in which the Necessary and Sufficient Weight of the Structure is Calculated, not Assumed; and the Number of Panels and Height of Girder that Render the Bridge Weight Least, for a Given Span, Live Load and Wind-Pressure, are Determined. By John Davenport Crehore, C. E. New York: John Wiley & Sons, 1886.

BINDING. — Subscribers to the Imperial edition, in sending to us for binding the issues for the past year, will do well to remember that we bind this edition in six months' volumes, the cost of a cloth binding being, as always, $2.00.

ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

CHURCH OF THE HOLY SPIRIT, MATTAPAN, MASS.; FRONT VIEW. MESSRS. ROTCH & TILDEN, ARCHITECTS, BOSTON, MASS.

[Heliochrome, issued only with the Imperial Edition.]

THE CHURCH OF THE HOLY SPIRIT, MATTAPAN, MASS. REAR VIEW. MESSRS. ROTCH & TILDEN, ARCHITECTS, BOSTON, MASS.

[Gelatine Print.]

THIS church was built as a memorial to the late Benjamin S. Rotch. A picturesque site suggested rustic treatment with rough-cast and boulders gathered from the lot. The interior is simply finished with pine throughout, except where the massive stone piers of the lantern tower are left to view. Hammer-beam trusses support the open-timbered roof.

The stained-glass was executed by Mr. Frederic Crowninshield, of New York.

THE VIRGIN PORCH, ST. MARY'S, OXFORD. AFTER AN ETCHING BY C. O. MURRAY.

THE stately High Street of Oxford boasts many beautiful monuments, and not least among them is the Church of St. Mary. The church itself is in the Perpendicular style, with a beautiful Decorated spire, richly ornamented with pomegranates, in honor of Queen Eleanor of Castile. The Italian porch which is shown in the etching is on the south side, and was erected by Morgan Owen, one of Archbishop Laud's chaplains. The image of the Virgin and Child was one of the principal articles on which the Archbishop was impeached.

Mr. Murray, the etcher of the original of our illustration is, we believe, a Scotchman, though for some years he has resided in London. He has done a large quantity of illustrative work, and has etched various plates, after paintings by Turner, Alma-Tadema, James Ward, Sir Henry Raeburn and others. One of his largest works is a reproduction of David Neal's "Cromwell's First Interview with Milton." He has lately turned his attention to original etching, and has published, among others, views of Walberswick, Mortlake, "A Kentish Village," and "Shakespeare's Tomb, Stratford-on-Avon." He is a member of the Society of Painter-Etchers.

BUFFET AND MANTEL FOR W. H. HOWARD, ESQ., SAN MATEO, CAL. MR. BRUCE PRICE, ARCHITECT, NEW YORK, N. Y.

DOORWAY OF THE CHURCH OF STE. MARTHE, TARASCON, FRANCE.

"THE STONE AGE," FOR FAIRMOUNT PARK, PHILADELPHIA, PA. MR. JOHN BOYLE, SCULPTOR.

	Parts.
Alum	600
Blood	1
Clay	1,900
Magnesia	5
Manganate of potash	10
Burnt clay	25
Chloride of sodium	10
Animal charcoal	15
Vegetable charcoal	20
Magnesian limestone	2

These were mixed with water, and added to the sewage, until no further precipitate resulted. About 4 lbs. of the mixture were required to every 1,000 gallons of sewage (= 28 grs. per gallon). The treated sewage then flowed into subsidence tanks, where the sediment was allowed to deposit. This sediment was used five or six times over as a precipitant, until its power in this respect was exhausted. After the sludge had been dried a small quantity of acid (preferably sulphuric acid) was added to fix the ammonia, in which state it was claimed to be valuable manure.

In 1869 the process was worked at Leamington, the composition of the precipitating mixture being

	Parts.
Alum	259
Clay	896
Charcoal	56
Clay blood	40
Carbonates of soda and potash	6
Previous precipitate	14
Perchloride of iron solution	1 pint

This mixture was added in the proportion of about 51 grs. per gallon, at a cost of £15 18*s.* per million gallons of sewage.

The mixture used at Leamington in 1870 was as follows:

	Parts.
Ammonia alum	336
Clay	672
Animal charcoal	15
Vegetable charcoal	20
Sulphate of magnesium	20
Clay blood	4

Of this composition 56 grains per gallon was found to be necessary.

In 1873 the process was used for a short time at Crossness for the treatment of 500,000 gallons daily of the sewage at the Southern Metropolitan Outfall. The mixture used had the following composition:

	Parts.
Sulphate of alumina	5
Charcoal	29
Clay	26
Mixed with a little blood.	

This was added in the proportion of 224 grains per gallon, and yielded 12.33 tons of manure per million gallons of sewage (5.25 tons of sewage, and 7.08 tons from the added chemicals), the ingredients costing £24 9*s.* 8*d.*

Tottenham, Hastings, Bolton (1872), Southampton, and Leeds, afterwards adopted the process, but in all it was abandoned on the



FRIEZE. BY J. A. DU CERCEAU. FROM L'ART.

THE TREATMENT OF SEWAGE.[1] — VII.

THE A B C PROCESS. — THE NATIVE GUANO COMPANY.

THE patent of the Messrs. Sillars and Wigner (1868) claims the use of alum, blood, and clay (hence termed the A B C process), with other agents, viz., compounds of manganese and magnesium, chloride of sodium, animal and vegetable charcoal, with the object —

(1.) Of deodorizing and purifying sewage by means of these chemical substances, and so obtaining a sediment which may be used as manure.

(2.) The deodorizing and purifying sewage by means of the mud already precipitated from sewage as above described.

(3.) The addition of an acid to the mud in order to retain ammonia, and so fit it for use as a manure.

The precise composition of the precipitating material has been changed from time to time. When first used at Leicester in 1868, the precipitating mixture consisted of

[1] A paper by Dr. C. Meymott Tidy, read before the Society of Arts, April 14, 1886, and published in the *Journal* of the Society. Continued from No. 573, page 292.

ground of cost. At Southampton a contract to deal with sewage was cancelled after £10,000 had been spent on works, owing to some erroneous expectations respecting profits.

At Bolton, 1872–73, the chemicals used were as follows:

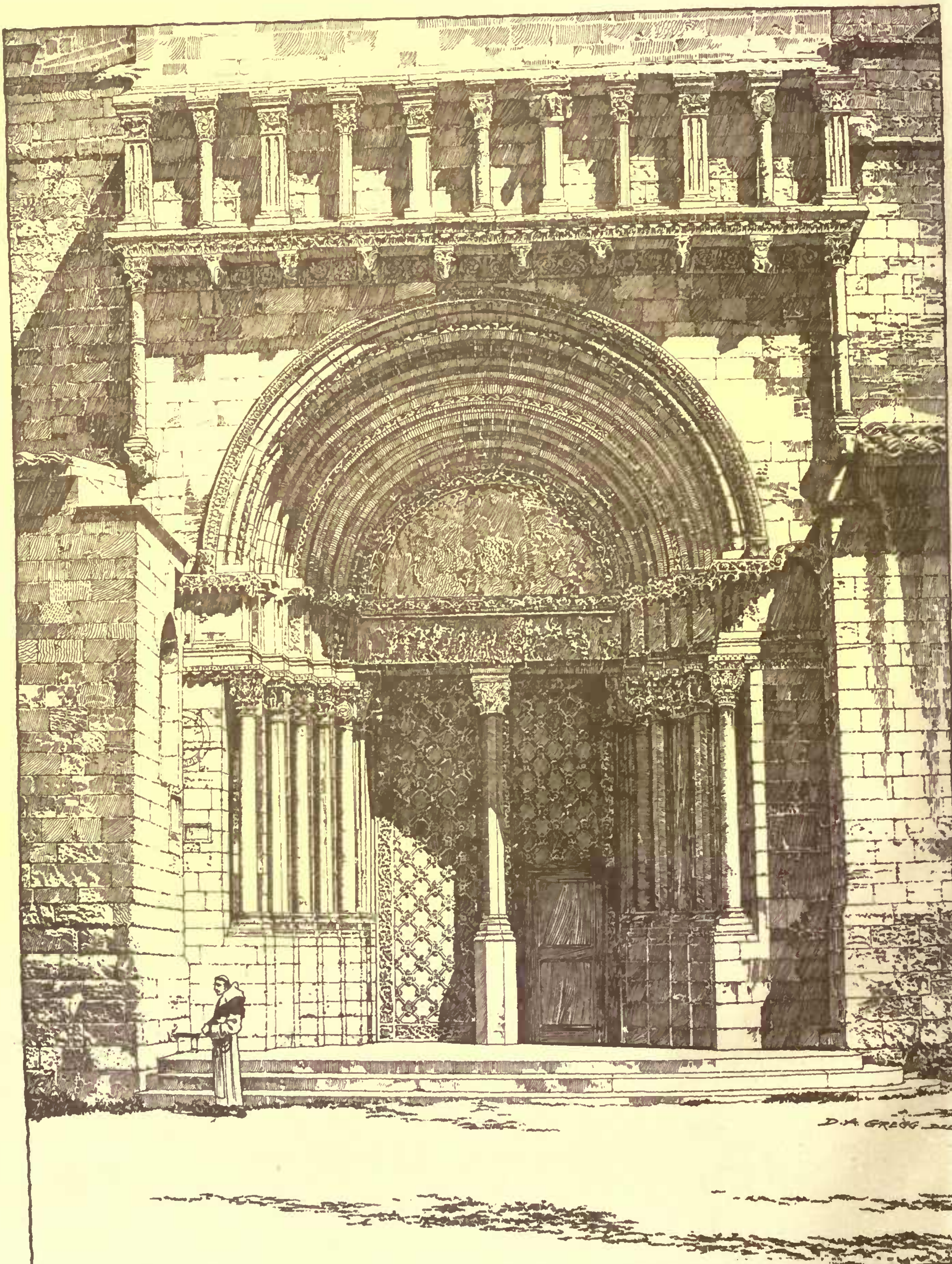
	Parts.
Sulphate of alumina	71
Clay	132
Carbon (waste from prussiate of potash factory)	81
Blood, small quantity.	

This mixture was added at the rate of about 90 grains per gallon. The quantity of sewage treated was 2,500,000 gallons daily. The process was abandoned on the ground of expense.

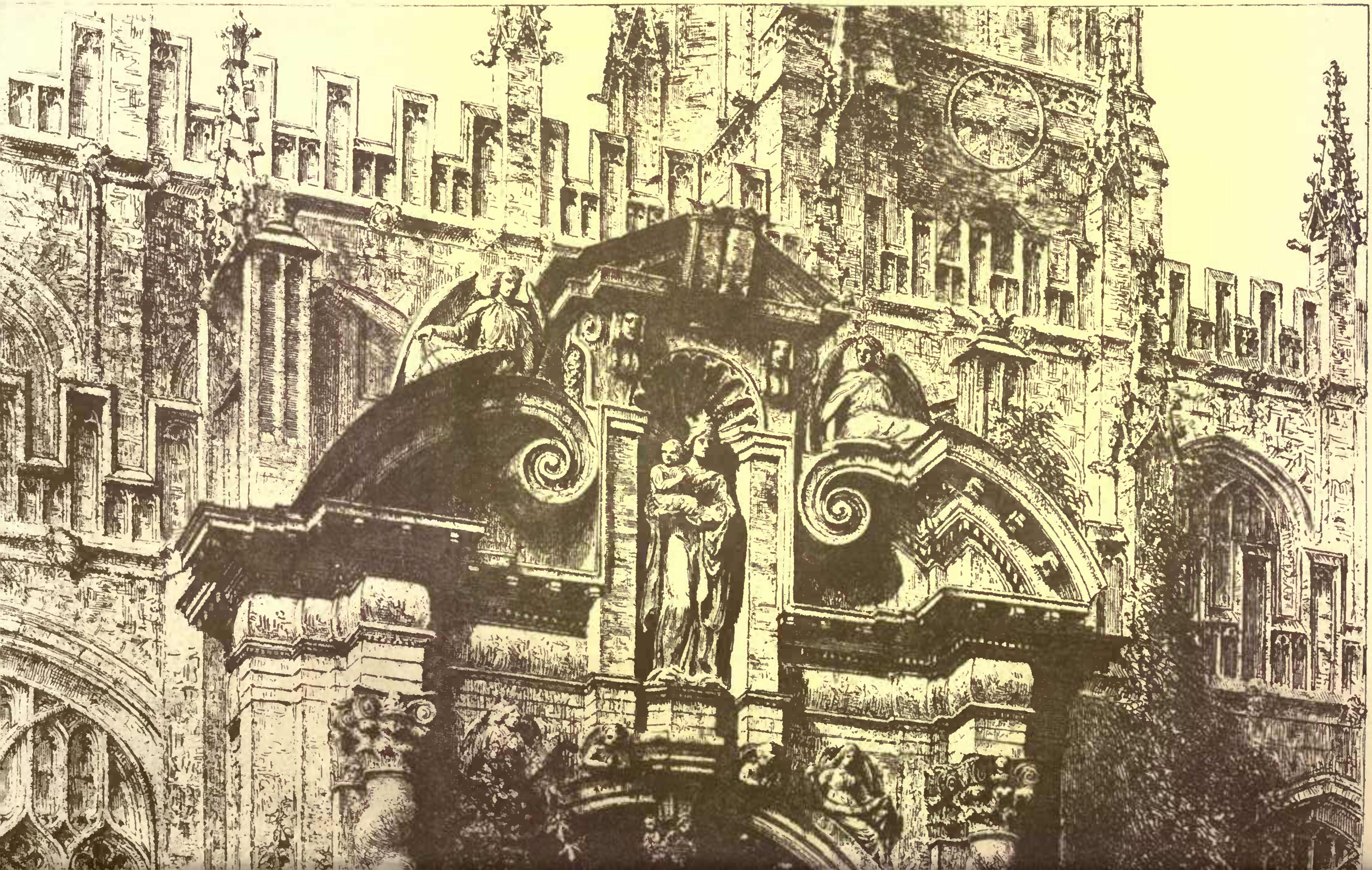
At Leeds, in 1870 (sewage 9,000,000 gallons daily, of which the A B C Company were to deal with 2,000,000) the precipitating mixture employed was:

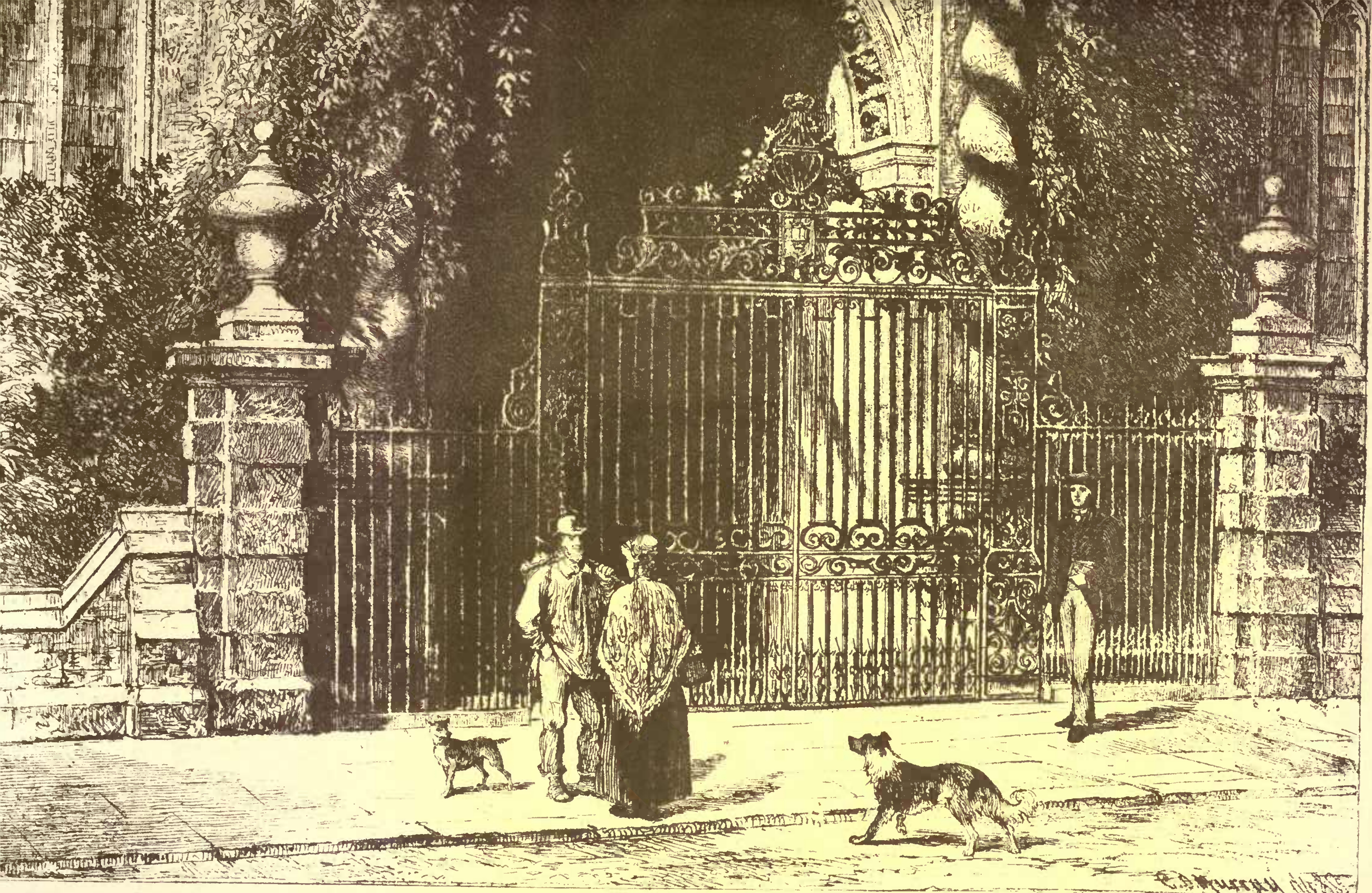
	Parts.
Alum	5,964
Carbon (refuse from prussiate of potash factory)	4,480
Clay	7,460
Blood mixture	56
Lime	186

About 120 grains per gallon of this mixture was employed. The



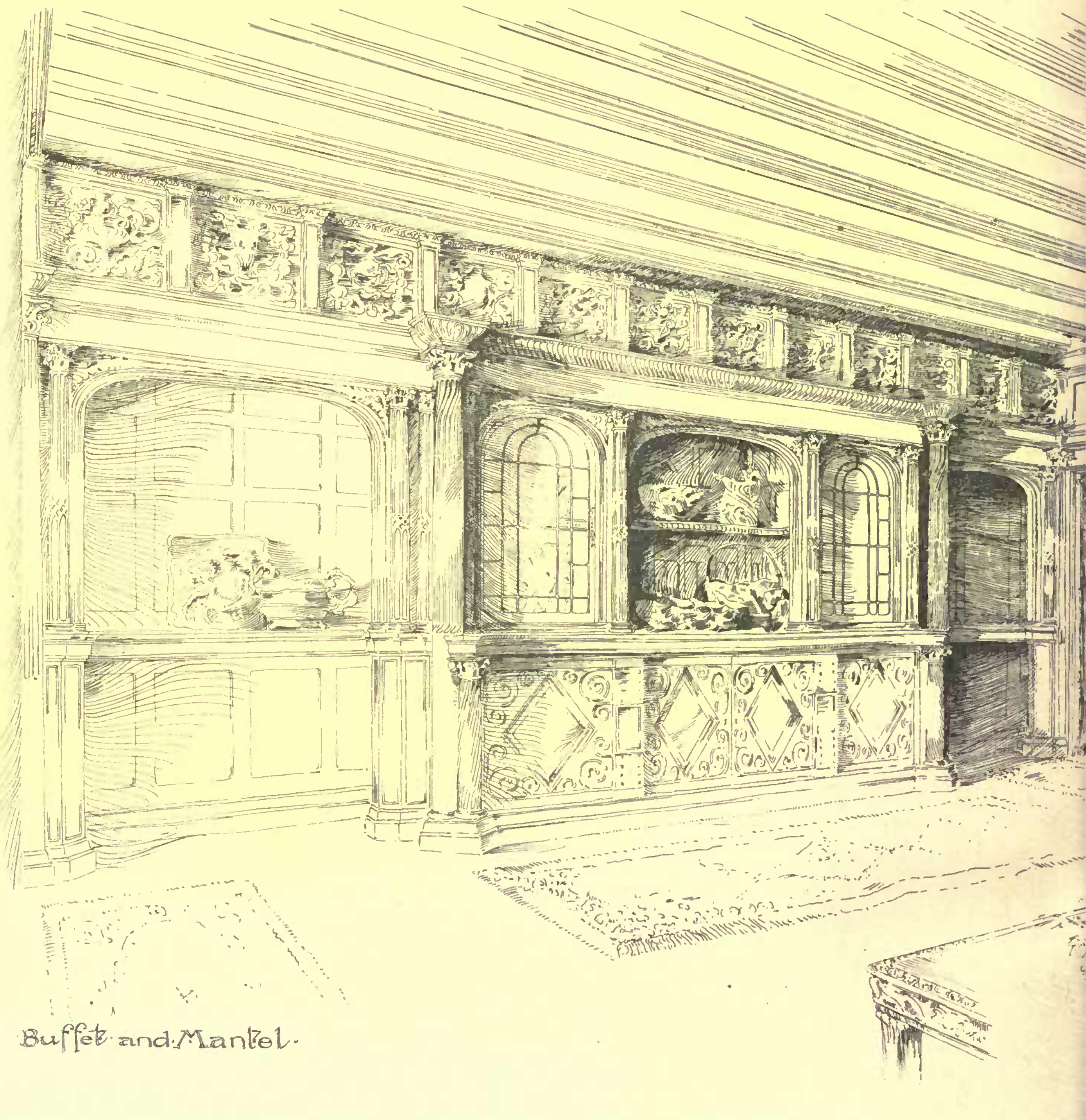
DOORWAY OF THE CHURCH OF STE MARTHE, TARASCON, FRANCE.



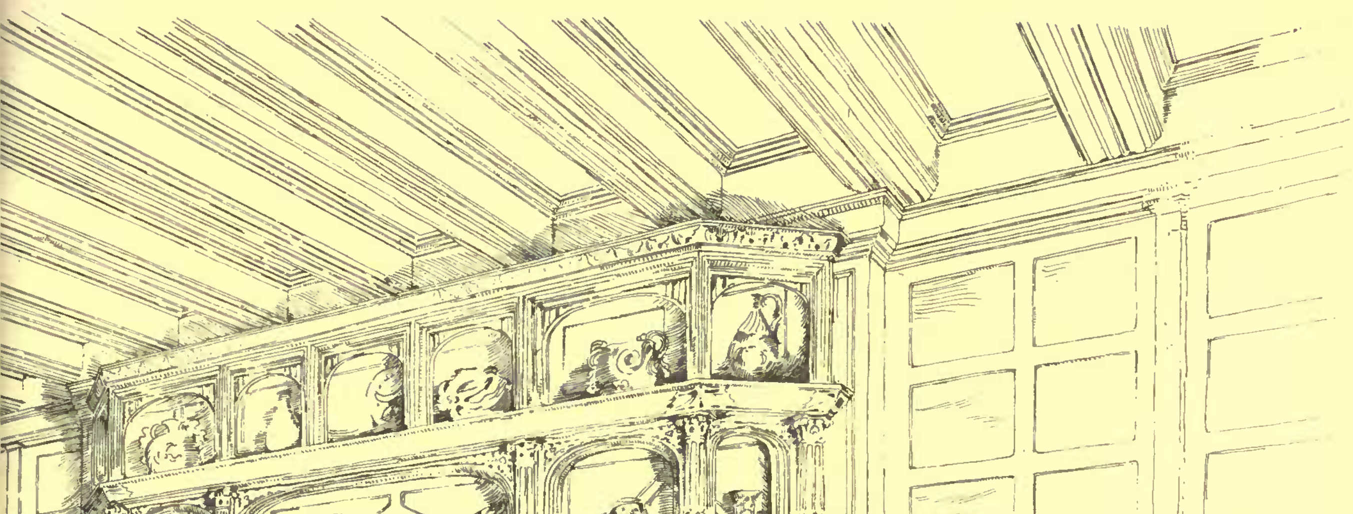


Heliotype Printing Co. Boston.

The Virgin Porch, St. Mary's, Oxford.



Buffet and Mantel.



·W·H·Howard· House· San Francisco·Cal·
·Bruce·Price·arch't· N.Y·

Heliotype Printing Co. Boston



"The Stone Age"

Fairmount . Park . Phila : John. J. Boyle . Sculpt.

Heliotype Printing Co. Boston.

cost for chemicals per million gallons was £7 5*s*. The company abandoned the works on June 1st, 1873. In June, 1875, however, they again treated the Leeds sewage for one week with the following precipitating mixture:

	Parts.
Lime	15,990
Animal carbon	13,556
Alum	8,076
Clay	16,848
Carbolic acid	28

About 40 grains of this mixture was used per gallon of sewage, at a cost of £2 8*s*. 10*d*. per 1,000,000 gallons.

Another trial was made for one week in January, 1876, when the cost of chemicals was found to be £3 5*s*. 9*d*. per million gallons.

The process, as carried out at Leamington (population 20,000, sewage 600,000 gallons daily in dry weather), was successful. The A B C mixture was stirred into the sewage in a circular tank, from which it passed into two settling-tanks, each set being used for one week, there being three sets of tanks for alternate working. The effluent then flowed into a channel 850 feet in length, 10 feet wide, 4 feet deep, the last third of which was converted into a filter of sand and animal charcoal, having a superficial area of 3,000 square feet. The sludge was converted into paste by centrifugal machines, revolving 1,500 times per minute, and afterwards further dried by exposure to air. It was then sprinkled with dilute sulphuric acid (1 part of acid to 6 of water), the acid being used in the proportion of one per cent of the manure. It was afterwards heaped for a fortnight, during which time it heated considerably, forming a rotten compost, which was further dried and sold for manure.

About 28 grains per gallon of the A B C mixture was employed, whilst the dried precipitate, containing 20 per cent of moisture, weighed about 80 grains.

At Hastings the works were situated on the seashore. The A B C material was agitated by a machine mixer with the sewage, and after flowing through subsiding tanks, was discharged into the sea.

The A B C process depends, in great measure, on the alumina as a precipitating agent. It is doubtful whether the blood is of any service, as it can scarcely be urged that in the quantity in which it is added, the fibrin can be of much value as an agent for entangling suspended matter. The clay is mainly a weighing agent, to assist the rapid subsidence of the suspended impurities.



General view of the Alhambra at Granada.

(From Report of the Com. Soc. of Architects Paris.)

Of course, the quality of the manure must depend on the quality of the sewage. Hence, as we should expect, its composition is not absolutely constant. Against the valuations of authorities we have the indisputable fact that it is being sold continuously for about £3 10*s*. per ton.

In the following report, numerous details relating to this process are discussed at length:

REPORT OF DR. C. MEYMOTT TIDY, M.B., ETC., AND PROF. SAMES DEWAR, F.R.S., ETC., ON THE A B C SEWAGE PROCESS.

TO THE DIRECTORS OF THE NATIVE GUANO COMPANY:—

Gentlemen,— The experiments recently carried out by us at Aylesbury for the purpose of determining the conditions and efficiency of the A B C process in the treatment of sewage being now complete, we transmit to you an abstract of the inquiry.

For this purpose you directed that the works were to be at our disposal, the process being continuously and uniformly worked under Mr. Page's management.

The following results, therefore, really represent the every-day working and the practical efficiency of the process.

For here we must remark that isolated observations on the composition of a sewage and of an effluent have no real value in testing the efficiency of a sewage process.

Considering the fact that the strength and composition of the sewage changes so rapidly and frequently it is manifest that conclusions deduced from a few observations are worthless and often misleading. Further, samples of effluent and of raw sewage collected at the same time have, as a rule, no definite relationship to each other, the passage of the sewage through the tanks occupying some hours.

For these and other reasons it appeared to us that, to arrive at a satisfactory conclusion on the A B C, or upon any other process, systematic and continuous experimental observations were needed; and further, that in order to obtain a fair average of the daily sewage delivered at the Aylesbury Works, each series of experiments must be continued for twenty-four consecutive hours at least, so as to embrace the varying conditions of the sewage. Samples of the raw sewage and of the effluent were therefore collected by us every half hour, equal portions of four consecutive half-hour samples being mixed together for chemical examination. The results obtained are tabulated, and represent the mean condition of the sewage and effluent during each consecutive two hours.

It was our special aim to select such dates for the collection of these twenty-four hour samples as would be likely to result in very different conditions of the average sewage. In this we were especially guided by the rainfall and other local conditions. We were fortunate in getting three series, differing considerably in the total quantity as well as in the strength of the raw sewage to be dealt with.

The next question we considered was the amount of sludge deposited from a given quantity of sewage, and of this sludge the proportions severally of the A B C precipitating materials and of sewage matter. A special arrangement was needed for this purpose, it being found impossible to determine these details with even an approach to accuracy in the large subsiding reservoirs. Four iron tanks, each holding about 200 gallons, were therefore divided by chalk lines, on the inside, into six equal divisions, one of these divisions being filled every hour, by means of a small force-pump placed in the narrow channel down which the treated sewage runs before entering Number 1 tank, with the sewage that had been already treated. The deposit in each of these four tanks, therefore, represented the mean amount of sludge produced during six consecutive hours. The sewage deposit in these tanks was allowed to settle and the clear effluent siphoned off. The deposited sludge was then dried at 212° Fahrenheit, and weighed. The quantity of carbon, clay and alum used during the twenty-four hours was determined, and substracted from the total (calculated) sludge.

Before considering the three series of experiments conducted by us, it may be advisable to give a brief description of the usual method of working the A B C process, and which, in our experiments, was carried out without innovation of any kind.

The sewage is delivered at the works, through an oval pipe about 2 feet in the longest diameter, into a small oblong space about 4 feet wide by 6 feet long, paved with bricks. Across this space, and about one yard from the sewer-mouth, a wooden V-shaped trough is placed, into which the B C mixture is run — even distribution into sewage being effected by means of numerous notches cut on the sides of the trough. By this means the sewage is completely and immediately deodorized, no escape of offensive odors from the sewage into the surrounding air taking place. The entire works are, in our experience, free from any objectionable smell whatsoever.

After being mixed with the B C mixture, the sewage passes through an iron grid for the purpose of catching paper, straw, and similar floating materials. It then passes along a brick-paved channel for about 12 feet, the channel afterwards narrowing to 2 feet in width. Here the alum solution flows in from a wooden trough in the same manner as we have described in the case of the B C mixture. The alum, it will be noted, is added some short time after the B C mixture. The addition of the precipitating ingredients separately, we are informed, is found to afford better results than when they are run in together.

The treated sewage flows along the 2 foot channel for about 40 yards, in order to facilitate mixture before it is allowed to run into the first subsiding tank. There are three subsiding tanks, each holding 42,000 gallons, through which the treated sewage successively flows before finally passing through a fourth and last tank, which is about double the size of the other three. On leaving the tanks the effluent, now practically free from suspended matter (as will be seen from the Tables) is devoid of smell, passes for several hundred yards along an open brick channel, before finally discharging itself into the brook.

The materials used for the precipitation of the sewage matters are clay, carbon, blood and alum, and they are manipulated as follows:

Weighed quantities of the clay and carbon are ground together in a mill with a certain small proportion of blood and some water. When thoroughly incorporated, the mixture is run into a reservoir placed beneath the mill, where a considerable proportion of the heavier clay particles subside, whilst the lighter particles of clay and carbon are added to the sewage as above described. The sulphate of alumina is dissolved in a separate tank, and is run directly from this into the sewage. The solution of alum used was found to contain on an average from 1 to 2 per cent of sulphate.

Before generalizing on the three series of experiments, it is necessary that we should consider each series separately, because although the same general system of research was adopted, yet modifications were introduced into each with a view of bringing out more clearly the probable influence of certain conditions.

No. 1 Series.

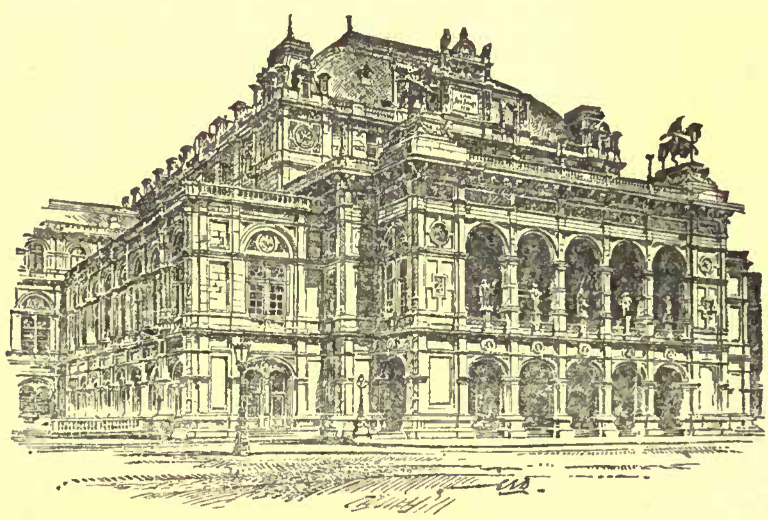
(*From* 8 *a. m. on January* 29, *to* 8 *a. m. on January* 30).

In the first series, especial attention was paid to the matters in suspension and in solution, both in the sewage and effluent, and the relation between the organic and inorganic portions respectively. The nitrogen, chlorine and organic matter were also determined.

We considered that the estimation of the quantity of organic matter present (especially the organic matter in the effluent) was of the first importance, and this we determined by the amount of oxygen required to oxidize it. By this method all the easily oxidizable substances are taken into account, including, at any rate, the organic matter especially liable to decomposition, and therefore those constituents particularly active in affecting the purity of a river by absorption of the dissolved oxygen of the stream.

The determination of the chlorine (present in the sewage in the form of chloride of sodium) was important, as indicating the strength of the sewage operated upon. At the same time we consider too much importance should not be attached to this ingredient, seeing that in an inconstant liquid like the sewage of a town, a large proportion of common salt may be derived from sources other than human excreta. The fact that the effluent generally contained slighly more chlorine than the raw sewage, is to be explained by the appreciable quantity of chloride introduced along with the materials used as precipitants.

The principal characteristics of Number 1 series are the large flow, the dilute condition of the sewage, and the excessive quantity of precipitating mixture used in its treatment. The flow measured 500,000 gallons, instead of 300,000, which we are informed is about the normal quantity. This dilution in great part accounted for the diminished strength of the sewage operated upon during the week.



The Opera-House, Vienna, Austria.

The average amount of oxygen required to oxidize the organic matter was in the sewage 1.795 grs. per gallon, and in the effluent 0.522 grs.; in other words, 74.8 per cent of the oxidizable organic matter had been removed by treatment, a result, in our opinion, satisfactory. Again, the total suspended matter in the sewage averaged 18.8 grs. per gallon, whilst that in the effluent was 1.92 grs. per gallon; in other words, the removal of 89.3 per cent of the suspended matter had been effected. The ratio of the inorganic to the organic in this suspended matter was in the sewage as to 1 to 1.18, and in the effluent as 1 to 6, showing that the small amount of suspended matter left in the effluent was principally organic. The matters in solution show a mean of 46.3 grs. per gallon in the raw sewage, and of 57.5 grs. per gallon in the effluent. This excess of soluble matter in the effluent depends on the large quantity of soluble salts introduced in the A B C mixture.

The mean quantity of nitrogen in the form of ammoniacal salts and of chlorine in the sewage and effluent are practically identical, and do not call for comment.

The total quantity of sludge produced can only be given approximately. An excessive quantity of precipitating material was in our opinion employed, and the subsequent series prove that the use of this large amount does not in any way improve the efficiency of the process. The curves plotted for this series illustrate graphically the variations, both in sewage and effluent, from hour to hour, and are useful as a ready method of noting the particular phases of the sewage and of the effluent at any hour of the day or night.

The irregularity of the lines representing the constituents of the sewage, and the comparative straightness of those representing the effluent, will at once be apparent; the high crest wave, indicating the maximum in the amount of all the sewage constituents between 12 noon and 6 p. m., being especially noticeable.

No. 2 Series.

(*From* 8.30 *a. m. on March* 2, *to* 8.30 *a. m. on March* 3).

The second series was devoted more especially to a consideration of the character of the organic matter as it exists in the sewage and in the effluent respectively. We considered it important, moreover, from a sanitary point of view, to determine the relative amounts of volatile and fixed organic matter.

For this purpose each sample of sewage was filtered, and the total organic matter determined, both in the unfiltered and filtered portion.

A certain quantity, therefore, of each sample of the filtered sewage was subjected to distillation, and the organic matter determined both in the distillate and in the residue left in the retort. The effluent was treated similarly, except that being practically free from suspended matter it did not require any previous filtration.

In this series the oxygen required to oxidize the organic matter in the unfiltered sewage averaged 4.076 grs. per gallon, whilst that required by the effluent was 0.677 grs. per gallon. Thus 83.3 per cent of the oxidizable organic matter had been removed by treatment — a result in our opinion, satisfactory.

The filtered sewage required an average of 1.75 grs. of oxygen to oxidize the organic matter per gallon; 61.4 per cent therefore of the oxidizable organic matter in solution had been removed.

The ratio of the volatile to the stable organic matter was, in the sewage as 1 to 6.9, and in the effluent as 1 to 5.7; that is to say, only one-seventh of the soluble organic matter in the sewage, and about one-sixth of that in the effluent was volatile along with the vapor of water.

The chlorine and ammoniacal nitrogen were again estimated, and, as before, were almost identical in amount, both in sewage and effluent.

The mean amount of suspended matter in the sewage was 59.97 grs. per gallon. Owing to the extremely small quantity in the effluent, it was thought unnecessary to determine it in every sample in this series. The one selected for estimation, as containing the largest amount, gave 1.89 grs. per gallon. Reckoned on this high estimate it shows that 96.8 per cent of suspended impurities had been removed by treatment. This series also showed a great improvement in the deposition of the sludge. The quantity of precipitating material used was only slightly more than one-third of the total weight of sludge produced, the absence of any appreciable amount of suspended matter in the effluent proving that efficiency was not impaired by the small quantity of material employed.

The chief characteristics, therefore, of Number 2 series are the very large flow, the greatly-increased strength of the sewage, and the improved working of the process, both as regards the sludge deposited and the percentage of organic matter removed.

This improvement can at once be seen by an examination of the curves for this series.

No. 3. Series.

(*From* 8.30 *a. m. on March* 16, *to* 8.30 *a. m. on March* 17).

This series of observation was taken, not only with the object of corroborating the other two, but principally on account of the very dry weather which had prevailed for the previous fortnight, and the unusual strength of the sewage at the time. We deemed it advisable to ascertain how the process would work under extreme conditions of a small flow and abnormally rank sewage.

The samples were examined in the same manner as the Number 2 series, the organic matter being divided into the volatile with water vapor, and the fixed (that is, not volatile with the vapor of water).

We consider that this method gives a certain insight into the nature of the organic matter present.

On considering our results in detail, it is apparent that a still further improvement has been effected in the working in the process.

Commencing with the organic matter, the average oxygen required by the raw sewage reached 6.8 grs. per gallon, whilst in the effluent it was 0.93 grs. per gallon, showing a removal of 86.3 per cent of the oxidizable organic matter.

The relation between the volatile and the stable organic matter in the filtered sewage and in the effluent was almost identical with that of the last series, being as 1 to 6.4 respectively.

On turning to the matters in suspension, a striking result was obtained. The quantity in the sewage reached the abnormally large amount of 243.6 grs. per gallon, while the effluent was so uniformly

devoid of turbidity that the sample taken for the estimation of the suspended matter, as containing a larger amount than any other, only gave 0.98 grs. per gallon.

In this series the sludge did not show quite so good a relationship to the precipitating materials, the total quantity deposited in the 24 hours being about half that of the Number 2 series. This is explained by the flow of sewage being very much less.

The chlorine and ammoniacal nitrogen were about the same in the sewage and effluent, a remarkable uniformity in this respect being apparent.

The characteristics of this series are somewhat different from those of the other two, viz., a much smaller flow (in fact, what is considered a normal flow, and an exceptionally strong and rank sewage. It will be seen by studying the curves relating to this series, that this exceptional state of things has not only interfered with the proper working of the process, but that the results obtained are positively better than in the other two series.

SUMMARY.

Reviewing and generalizing upon the results thus detailed, the following facts seem to us established: —

In the first place, there is no doubt that the A B C process is capable of producing a uniform effluent, notwithstanding the very varied nature and concentration of the raw material to be dealt with.

The quality of the effluent, however, more especially as relates to the quantity and kind of dissolved organic matter, unquestionably depends upon the strength of the original sewage. This will be seen by comparing the following numbers for the three series: —

	1	2	3
Average am't of oxygen absorbed by organic matter in the sewage	1.79	4.07	6.8
" " " " " effluent	0.52	0.67	0.93
Per centage of oxidizable organic matter removed	74.80	83 30	86.30

This, in our judgment, is a satisfactory result, because although the effluent is certainly not so good as in the case of a strong as with a weak sewage, nevertheless, the efficiency of the process is proved to be actually greater with regard to the total quantity of organic matter removed, a result we hardly anticipated. Too much importance must not be attached to the numerous isolated cases in which as little as 0.2 or 0.3 grs. per gallon of oxygen was required to oxidize the organic matter in the effluent, it being found that the sewage operated upon was in these cases excessively dilute.

There seems no reason to doubt that a minimum quantity of organic matter in the effluent might be permanently maintained, if the weak nightly sewage could be stored in reservoirs and afterwards mixed and treated along with the stronger day sewage, or if the effluent was collected in large reservoirs and allowed time to mix and become of a more uniform character before discharge.

With regard to the removal of the suspended matter the process is satisfactory, and there is no doubt that an effluent can easily be obtained with due care (and this irrespective of the original sewage) practically clear, that is, containing less than 1 gr. of suspended matter per gallon. In fact, the precipitation appears to be more complete as the quantity of suspended matter in the raw sewage increases.

The chlorine, though it increases regularly with the strength of the sewage, shows a slight increase in the effluent, owing to the quantity introduced by the precipitating materials.

The nitrogen, in the form of ammoniacal salts, also seems to be unaffected by the process, being in all three series practically the same in amount, both in the effluent and in the sewage.

With respect to the removal of any soluble, inorganic salts by the process, it is difficult to speak with precision, owing to the quantity introduced by the precipitating materials, whilst the phosphoric acid, which principally exists in the urine, is, no doubt, precipitated as phosphate of alumina. The soluble organic matter precipitated from solution is also considerable, amounting in Number 2 series to 61.4 per cent, and in Number 3 series to 57 per cent of the whole.

The organic matter in the effluent is evidently mainly composed of the salts of fatty acids and such like bodies. The fact that on evaporating down a large quantity of the effluent, and throwing it on a dialyser or diffusable membrane, at least two-thirds of the organic matter diffused, showed that it could not be of an albuminous or complicated colloidal nature, and was, therefore, of a nature less liable than these bodies to putrefactive and other changes. This conclusion is further borne out by a consideration of the volatile alkaline and acid portions of the organic matter. Dividing the readily oxidizable organic matter into six parts, the relations between them was as follows: 1 part volatile and alkaline; 2 parts volatile and acid; 3 parts non-volatile.

EXAMINATION OF THE SLUDGE.

The second part of the A B C process consists in the drying of the sludge and its conversion into a saleable manure, known under the name of native guano.

The following is a brief account of the different stages of the working: The semi-liquid sludge in the tanks, containing about 90 per cent of water, is pumped into a large reservoir situated on the roof of a tower some 40 feet high, and immediately above the filter presses. Here it is allowed to settle. The comparatively clear water lying on the surface, as well as the expressed fluid of the sludge are both returned to the sewer just above the sewer mouth, to be again treated along with the raw sewage, and with which it mixes.

The sludge is now run into the two large filter presses, and as the water is squeezed out fresh quantities of sludge are turned into the presses by a special feeding arrangement until they are full. The sludge, as it comes from the filter presses, is in the form of stiff cakes, containing from 55 to 60 per cent of water. This material, after admixture with some sulphate of magnesia, is then passed through a specially-constructed drying-cylinder, which delivers it in a more or less granular condition. This operation extracts about 25 per cent more of the water, the granular manure containing now from 30 to 35 per cent.

The water evaporated from the semi-fluid sludge is condensed in a coke tower, through which a stream of water falls continuously, effectually preventing the dissemination of any offensive smell into the surrounding air.

From the drying-shed at the works the manure is removed to a large depôt in the town, where by grinding it is reduced to a coarse powder. Here it is stacked in a shed and placed in bags for the market. Although no further artificial drying is resorted to, it gradually loses more and more of its moisture by air-drying, and is usually sold with from 14 to 18 per cent of moisture in it.

The native guano is, in fact, nothing but the partially-dried precipitated sludge, mixed with some sulphate of magnesia and ground. The one curious part of the process is, the large amount of heat developed in the interior of the heaps of the cylinder-dried manure, both before and after grinding. This continues for many months in the stacked manure without any apparent diminution. The temperature varies slightly according to the depth of the heap at which it is registered, but finally reaches a maximum of about 113° Fahrenheit, at which it remains stationary for months.

There is no appearance of steam or other sign of heating on the surface of the heap, but when turned over about a foot deep, dense clouds of steam having a distinct smell of ammonia and showing an alkaline reaction to litmus paper are evolved.

It was thought, therefore, that a very appreciable loss of ammonia must result from this action, and for the purpose of testing this, samples of the gases evolved from the centre of the heap were collected and examined. The result shows, however, that these contained only .01 per cent of ammonia and 5 per cent of carbonic acid, suggesting that the heating action was due to oxidation and not to any fermentative process involving a loss of ammonia. What is very remarkable, however, is that the absorption of oxygen does not seem to involve a production of nitrates, which is the usual accompaniment of combined fermentative action and oxidation, and indicates probably in this case that the oxidation is mainly confined to the non-nitrogenous constituents of the sludge.

In order to decide the possible loss of ammonia in the preparation and subsequent heating, samples of the pressed sludge and of the manure, both before and after grinding, were submitted to the continuous action of a current of dry air at 212° Fahrenheit for some hours. By this means we were enabled to determine the amount of ammonia that could really be driven off under exceptional circumstances. The ammonia was estimated both in the dried portion and in that portion driven off by heat, the total quantity in the dry manure being also determined.

The results obtained are stated in the following table:

No.	Description of sample.	Per centage of moisture.	Ammonia, per cent.		
			Loss at 212° F.	In dry sludge.	Total in manure.
1	Sludge direct from press, 13 | 2 | 85	61.8	.072	3.23	3.302
2	" " 26 | 2 | 85	57.4	.080	3.39	3.570
3	Sludge immediately after passing through cylinder	51.1	.003	3.10	3.103
4	Dried sludge, after lying about three weeks at works	30.3	.170	3.80	3.970
5	" " at depôt about three weeks	33.7	.480	3.41	3.890
6	Manure, immediately after grinding	31.7	.200	3.87	4.070
7	Ground manure from front of heap, 1 yard deep	29.6	.350	3.59	3.940
8	" " top of heap (ground about two weeks)	35.4	.303	3.55	3.853
9	Ground manure from side of heap, 1 yard deep (about one month)	34.3	.320	3.52	3.840
10	Ground manure from centre of heap, 1 yard deep (ground five months)	28.0	.270	3.94	4.210
11	Ground manure from back of heap, 1 yard deep (ground seven to eight months)	17.2	.120	3.61	3.730

The above table shows that a small portion only of the ammonia is evolved even at the temperature of boiling water, a fact that was further confirmed by passing several cwts. of the sludge a second time through the drying-cylinder. In this way we obtained a manure containing only 20 per cent of moisture without its manurial value being sensibly affected so far as the loss of available ammonia was concerned. It will also be seen that the average total amount of ammonia is practically the same from every part of the stacked heap, not being effected by the continuous action of heat after several months.

The percentage of combined nitrogen in the manure is consequently remarkably constant, and amounts to an average of 3.8 per cent, reckoned as ammonia in the perfectly dry manure, or, if with 20 per cent of water, to 3 per cent of available ammonia.

As the phosphoric acid is also an important ingredient from a manurial point of view, it was estimated in four samples of the manure taken from different parts of the heap, an average of 5.0 per cent, reckoned as tricalcic phosphate of lime being found. As to the manurial value of the native guano, we are strongly of opinion

that this must be judged rather by the practical results of the agriculturist than by presumed theoretical values based on analytical data, and on the price of ingredients not necessarily in the same physical or chemical condition. Recent research tends to show that very small changes brought about in soils may have very important indirect effects.

We desire to express our obligations to Gerrard Ansdell, Esq., F.C.S., for the ability and attention he has devoted to this inquiry.

We remain, Your obedient servants,
C. Meymott Tidy,
James Dewar.

April 29th, 1885.

[To be continued.]

COMMUNICATIONS

A CORRECTION.

New York, December 16, 1886.

To the Editors of the American Architect: —

Dear Sirs, — Permit me to correct your answer to Mr. Frederic's question in your last issue relating to the building shown on the extreme right in your gelatine print of the Manhattan Storage Warehouse, *American Architect*, November 27. The building, which is situated on the northwest corner of Forty-second Street and Lexington Avenue, is the hospital for ruptured and crippled children, and was built some fifteen years ago from plans made by Edward T. Potter, architect. I am, Truly yours,

Wm. A. Potter.

NOTES AND CLIPPINGS

Preservation of exposed Ropes. — The preservation of exposed ropes is a matter of great importance when scaffolding remains erected for any considerable time, especially in localities where the atmosphere is destructive of hemp fibre. It has been suggested that in such cases the ropes be dipped, when dry, into a bath containing 20 grains of sulphate of copper per litre of water, and lie in soak in this solution for four days, afterward being dried; the ropes will thus have absorbed a certain quantity of sulphate of copper, which will preserve them alike from rot and from the attacks of animal parasites. The copper salt may be fixed in the fibre by a coating of tar, or by soapy water. In tarring the rope it is said to be better to pass it through a bath of boiled tar, hot, drawing it through a thimble to press back the excess tar, and suspending it afterward on a staging to dry and harden. According to another process the rope is soaked in a solution of 100 grains of soap per litre of water; the copper soap thus formed in the fibre of the rope preserves it from rot even better than the tar, which acts mechanically to imprison the sulphate of copper, which is the real preservative. — *The Iron Age.*

Why Insurance-rates in Boston are High. — The cost of insurance is becoming, to small manufacturers in Boston, one of the most grievious of their expenses. Along Federal, Congress and High Streets, where our best buildings are located, two and three per cent is a very common rate, and at this it is difficult, even in what might be called our best buildings, to get fully covered. We recall a building near the corner of Federal and Franklin, where a floor has been vacant for over a year, simply because there cannot be insurance enough secured to cover the business that would be likely to occupy so large a place. A number of property-owners have reported that they have been obliged to reduce their rents in this locality because of the advance in insurance rates. We think that, if property-owners, when building, would leave their brick walls unsheathed, brick both sides of their stairways and put-in iron stairs, brick up their elevators and have tin-covered and also iron doors into these wells, grout the floors so that water could not run through, and then decline to cut holes through the walls to connect with the next building to accommodate a tenant, all this property would be written for one per cent. Every building devoted to manufacturers' purposes ought to be inspected weekly by either the fire or protective departments, and when negligence in cleanliness and disregard of the building laws is found, on the spot, with the evidence in view, the owner should be fined. Recently, passing through the byways of our busy centre, at the back door of a six-story building, in which over 200 men and women were employed, with an unprotected elevator-well going up beside a wood-cased stairway, boys were packing straw-stuffed barrels at the entrance, and a man loading slatternly-tied bags of book-binders' trimmings. The boys were smoking cigarettes and the teamster a pipe. The building is a two per cent risk, the largest tenants short insured, and this peculiar exposure an almost daily occurrence. The bottom of the elevator-well, the engineer said, had never, to his knowledge, been swept out, and the appearance of things confirmed his statement. — *Manufacturers' Gazette.*

Existent Forests. — The supply of available timber is rapidly diminishing in all parts of the civilized world. It may be of interest to note a few facts in this connection. The land capable of bearing or actually bearing timber in Sweden has been estimated by government inspectors at 30,000,000 acres. Down to the present time the Swedish Government has continued to show the greatest solicitude for the preservation of both public and private forests, and minute regulations are in force which, if carried out cannot fail to make the Swedish forests a source of permanent income. They are not living on their capital there, as some countries have done, and are, therefore, able to take the utmost advantage of the exceptional conditions which nature has bestowed. In Nova Scotia the approximate amount of timber-producing land was in 1875 computed at 9,000,000 acres; in Ontario, 30,000 square miles; in Quebec, 115,174 square miles; in New Brunswick, less than 10,000 square miles. In British Columbia about 180,000 square miles are covered with lumber. Newfoundland has a large area of forest land. In Natal, Africa, the crown forests have been seriously drawn upon. It is computed that Cape Colony has only between 500 and 600 square miles of forest. Between 1868 and 1878 British Honduras sent out 34,000,000 feet of mahogany. In Victoria, Australia, timber is diminishing at a rapid rate, while in Western Australia the Government will take immediate steps to arrest destructinn. In Queensland an annual license fee is exacted from wood-cutters. Tasmania, Van Dieman's Land, has about 8,000,000 acres under timber, of which about 1,000,000 acres are in private hands. — *Metal Worker.*

How Iron Breaks. — Hundreds of existing railway bridges which carry twenty trains a day with perfect safety, would break down quickly under twenty trains per hour. This fact was forced on my attention nearly twenty years ago, by the fracture of a number of iron girders of ordinary strength, under a five-minute train service. Similarly, when in New York last year, I noticed, in the case of some hundreds of girders on the elevated railway, that the alternate thrust and pull on the central diagonals from trains passing every two or three minutes had developed weaknesses which necessitated the bars being replaced by stronger ones after very short service. Somewhat the same thing had to be done recently with a bridge over the river Trent, but the train service being small, the life of the bars was measured by years instead of months. If ships were always among great waves, the number going to the bottom would be largely increased. It appears natural enough to every one that a piece, even of the toughest wire, should be quickly broken if bent backward and forward to a sharp angle; but perhaps only to locomotive and marine engineers does it appear equally natural that the same result would follow in time if the bending were so small as to be quite imperceptible to the eye. A locomotive crank axle bends but one-eighty-fourth inch, and a straight driving-axle a still smaller amount, under the heaviest bending stresses to which they are subject, and yet their life is limited. During the year 1883 one iron axle in fifty broke in running, and one in fifteen was renewed in consequence of defects. Taking iron and steel axles together, the number then in use on the railways of the United Kingdom was 14,848, and of these 911 required renewal during the year. Similarly, during the past three years no less than 228 ocean steamers were disabled by broken shafts, the average safe life of which is said to be about three or four years. Experience has proven that a very moderate stress, alternating from tension to compression, if repeated about 100,000,000 times, will cause fracture as surely as a bending to an angle repeated only ten times. — *B. Baker, C. E.*

The Dry-rot Fungus. — In an interesting article by Mr. Worthington G. Smith, in the *Gardeners' Chronicle*, a few noteworthy remarks are made on the dry-rot fungus. The writer observes that he has "seen it growing on damp concrete between the girders of iron fireproof floors, and seen it spread from wood on to plate-glass, and perfect itself on the latter substance whilst drawing its nourishment from the wood." Our experience of its growth is equally remarkable. A house, probably 70 years old had been tenanted for a short time, when the owner consulted an architect as to the rapid decay of the painted plastering in the dining-room. The wall being a party-wall, and the house quite dry, any suspicion of dampness could not be entertained. An efflorescence of a white or livid gray color appeared behind some of the pictures hung on the walls; on touching the surface it was found to crumble and fall into dust. There was a wine cellar underneath. The floor was carried on massive oak beams, and these were found to be, in parts, covered by the same growth, and easily crumbled to the touch. In this instance the disease had spread from the cellar upwards, and was found in the wall itself, in the mortar-joints, and also around some of the corks of the bottles. Mr. Smith writes: "the dry-rot fungus prefers the squared unpolished wood of coniferous trees as a substratum on which to luxuriate, but we have seen it on polished mahogany, and it will spread from other woods to teak, and destroy teak-built ships." The author says there are twelve British species of Merulius, inclusive of *M. lachrymans.* The *M. corium* is almost as destructive. An interesting illustration is given of the dry-rot fungus; the plant has a livid color and is thick and fleshy to cut, the odor mushroom like. The central part of the Merulius has a rich reddish-brown color, and is indented with shallow pores or wrinkles. A reddish juice is exuded, which stains every object with which it comes in contact, and this exudation, by extracting the juices of the wood, leaves it in a state of dry powder. The fungus, after extracting all the juices, perishes, but not before it has produced myriads of spores, which are carried away to do similar havoc to other damp timber. Mr. Smith says: "As the air of the infected building is full of dry-rot spores, it is useless to replace old wood with new, for new wood merely supplies fresh food for the fungus." It is impossible, he says, to cure dry-rot, or to stop its progress. Referring to the use of various remedies, like petroleum, Burnett's chloride of zinc, Kyan's method of corrosive sublimate, creosoting, etc., the author places more confidence in the last, or Bethell's process. The most effective heavy creosote, for timber preservation, is derived from the best Newcastle coals. The efficacy of creosoted timber depends on the quality and constituents of oil of tar and the method of forcing it into the pores of the timber. Without damp, stagnant air and wood saturated with moisture, the dry-rot fungus cannot exist, and the chief preventive is to keep those evils away. Foundations should be well built with cement on concrete or rock basements, the latter should be well ventilated, and the timber should be perfectly sound and dry, and it is only by neglect of common-sense precautions that the dry-rot destroys so many buildings. Mr. Smith shows that it is impossible to cure rotten timber; prevention of the attack of fungus is the main resource. — *The Building News.*



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